AD-A105 820 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. WATERVLIET UPPER DAM (INVENTORY NU--ETC(U)
JUL 81 G KOCH DACW51-79-C-0001
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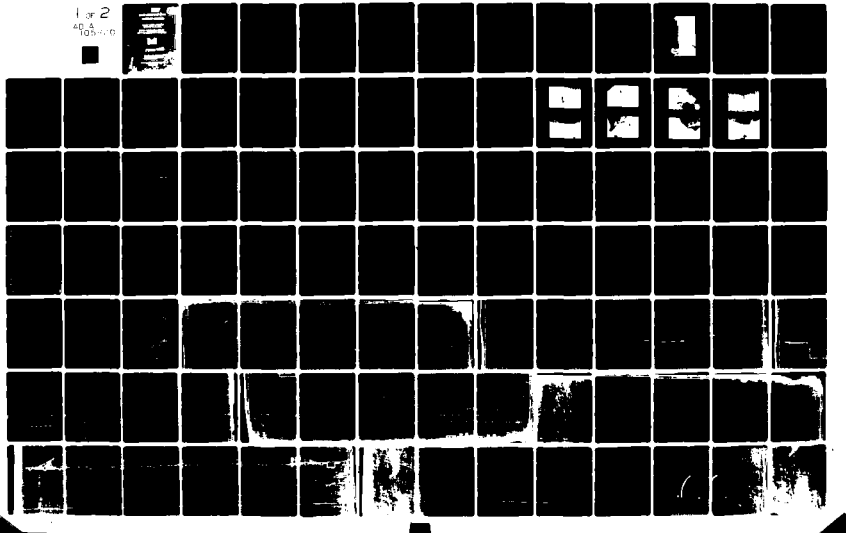

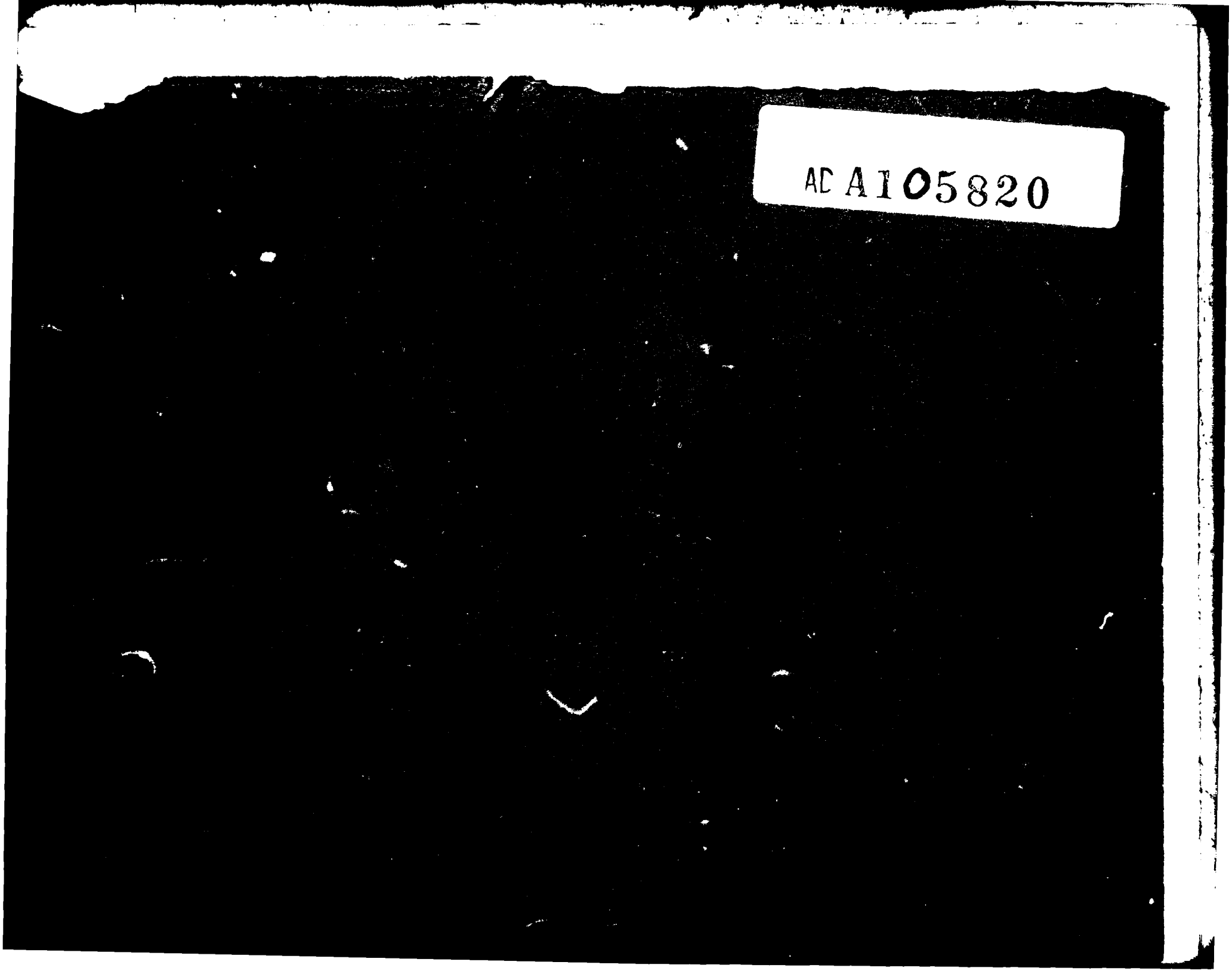

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam at the report date. Information and analysis are based on visual inspection of the dam by the performing organization. **The examination of documents and visual inspection of the Watervliet Upper Dam and appurtenant structures did not reveal conditions which constitute a hazard to human life or property.**	

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The discharge capacity of the spillway is inadequate for all storms in excess of 55% of the PMF (Probable Maximum Flood). During the 1/2 PMF event, the maximum water surface will be 1.2 feet below top of dam. However, the dam will be overtopped by 2.3 feet during the full PMF; therefore, the spillway is assessed as "Inadequate".

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WATERVLIET UPPER DAM
I.D. No. NY 1356
DEC # 226A-1407 LOWER HUDSON RIVER BASIN

TABLE OF CONTENTS

Phase I Inspection Report
National Dam Safety Program

Name of Dam:	Watervliet Upper Dam (I.D. No. NY 1356)
State Located:	New York
County Located:	Albany
River:	Dry River (tributary to Lower Hudson River)
Date of Inspection:	November 7, 1980

ASSESSMENT

The examination of documents and visual inspection of the Watervliet Upper Dam and appurtenant structures did not reveal conditions which constitute a hazard to human life or property.

The discharge capacity of the spillway is inadequate for all storms in excess of 55% of the PMF (Probable Maximum Flood). During the 1/2 PMF event, the maximum water surface will be 1.2 feet below top of dam. However, the dam will be overtopped by 2.3 feet during the full PMF; therefore, the spillway is assessed as "Inadequate".

The following problems were observed which require remedial action within one year of notification to the owner:

1. Monitor the erosion observed at the abutment contacts of the downstream slope and repair as required.

2. Repair the seeping and deteriorated concrete surfaces of the horseshoe conduit.

3. Periodically remove the debris and sediment from the vicinity of the intake tower and the downstream channel.

4. Remove the tree and brush growth from the embankment and abutments. Provide a program of periodic cutting and mowing of these surfaces.

5. Provide a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference.

6. An emergency action plan must be developed.

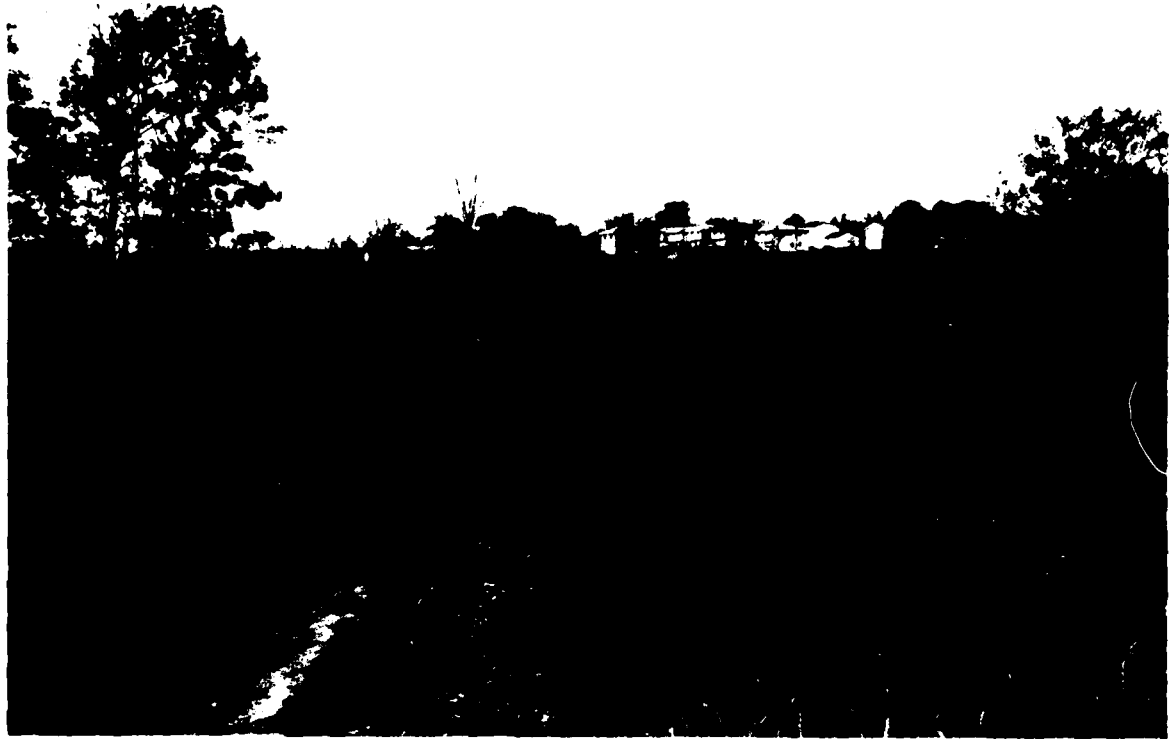


Photo #1
Overview, Watervliet Upper Dam
from left abutment looking across the top of
the embankment

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WATERVLIET UPPER DAM I. D. No. NY 1356
DEC # 226A-1407 Lower Hudson River Basin

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to human life and property and recommend measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Watervliet Upper Dam consists of a 72 feet high homogenous earth embankment with a 6 inch concrete core wall. The spillway is a tower type intake with a 3 foot radius, modified horseshoe conduit. The normal water surface is approximated by the low stage inlet of the tower, resulting in no impoundment during normal conditions. The embankment is approximately 500 feet long. The 440 feet long conduit is reinforced concrete on a slope of 1.13%. The invert elevation is level with the toe of the embankment resulting in no normal pool behind the dam. There are several large openings located on the sides of the tower; as seen in the photos. There is no overflow or emergency spillway as indicated on plans.

b. Location

The dam is located on Dry River, tributary to the Lower Hudson, west of Watervliet, Albany County, New York.

c. Size

The dam is 72 feet high and impounds approximately 1220 acre feet at top of dam. The normal water surface elevation is kept at the toe of the dam, resulting in no impoundment during normal conditions. The dam is, therefore, classified as intermediate (40 to 100 ft. high, 1,000 to 5,000 acre feet).

d. Hazard Classification

The dam is classified as high hazard due to its location in relation with the City of Watervliet. The downstream channel is confined by some low lying homes and converts into a closed system within the City.

e. Ownership

The dam is owned and maintained by the City of Watervliet, New York. Mr. Jim Davin, Supt. D.P.W., was our contact with the owner. He can be contacted at City Hall, Watervliet, NY (518) 270-3821.

f. Purpose of the Dam

The dam was designed as a storm water detention dam.

g. Design and Construction History

The dam was constructed in 1912 by Leary and Morrison Co. and designed by Solomon, Norcross & Keis, Watervliet, New York. There has been no recorded changes to this structure since original completion.

h. Normal Operating Procedures

All releases from the Upper Reservoir are passed through the orifice and conduit. The system involves no operation. Maintenance is on an "as needed" basis.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	2.88
b. Height of dam (ft.)	72.
c. Discharge at Dam Site	
Maximum Spillway Capacity (cfs.)	272.
d. Elevations (ft., USGS.)	
Top of Dam	215.
Spillway Crest	148.
Original Streambed	145.
e. Storage (acre ft.)	
Top of Dam	1217.
Normal	0

f. Dam

TYPE: Homogeneous earth fill with concrete core wall.

Length (ft.)	500.
Upstream slope	2.5: 1
Downstream	2.0: 1
Crest Width (ft.)	20.

g. Spillway

TYPE: Reinforced concrete tower intake; modified horseshoe tunnel through embankment.

Conduit Length (ft.)	440.
Slope (%)	1.13

SECTION 2: ENGINEERING DATA

2.1 GEOLOGY

The Watervliet Upper Dam is located in the Hudson Mohawk Lowlands physiographic province of New York State. The general topography of this province resulted from erosion along outcrop belts of weak rocks. Most of the province has low relief and elevation. Bedrock in the vicinity of the dam is Ordovician shale 500 to 435 million years ago which has been exposed by the southward and westward stripping - off of Silvrian and Devonian Limestones.

Glacial cover has resulted from deposition during the Wisconsin glaciation, approximately 11,000 years ago.

The "Preliminary Brittle Structures Map of New York" developed by Yngvar W. Isachsen and William G. McKendree (dated 1977) indicates the presence of a gravity slide (rock into sediments) of the Early Taconian orogenic age, located in the watershed above the dam.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigation could be located for the design of the structure. The "General Sail Map of New York State" prepared by Cornell University Agricultrue Experiment Station indicates that the surficial soils in the vicinity of the dam are the Hudson series of Glacial Lake and Marine sediment origin. These soils were formed on Lacustrine bottom sediments, and consist of varied silt sand and clay. The permeability is generally very slow. The depth to bedrock is variable. Bedrock was observed in the downstream and upstream channels.

2.3 DAM AND APPURTENANT STRUCTURES

The design of the dam was prepared by Solomon, Norcross & Keis, Engineers for the Watervliet Storm Sewer Commission in November, 1911. All pertinent drawings concerning the structure are included in Appendix E.

2.4 CONSTRUCTION RECORDS

No construction information was available.

2.5 OPERATION RECORDS

No operation records are maintained for the dam.

2.6 EVALUATION OF DATA

The data presented in this report has been compiled from information obtained from Mr. Jim Davin, Supt. of D.P.W., Watervliet, NY (518) 270-3821, and the NYS Department of Environmental Conservation files. This information appears adequate and reliable for Phase I Inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Watervliet Lower Dam and the surrounding watershed was conducted on November 7, 1980. The weather was partly cloudy and the temperature ranged in the forties. The water level at the time of the inspection was approximating the inlet elevation of the reservoir drain, and only a small stream of water was apparent in the upstream area.

b. Embankment

The earth embankment shows no signs of major distress. While some minor erosion was apparent on the rock and earth slopes of the abutment areas of the downstream slope of the dam, no evidence of sloughing, sliding, seepage, depressions, or unusual growth was apparent. The slopes and crest of the embankment are heavily vegetated with small diameter trees and brush.

c. Spillway

The only spillway is the intake tower, located near the center of the embankment at the upstream toe of the dam. The tower has numerous screened intakes at various elevations along the sides of the tower. The area surrounding the tower periodically fills in with sediment and requires cleaning of this material and the associated debris. The modified horseshoe conduit is generally in good condition; several small areas were observed which were seeping slightly (less than 1 gpm) and exhibited either a rusty or calcification strain, surrounding the seepage point. The concrete of the intake tower and the conduit is in good condition with the exception of some minor deterioration in the vicinity of the seepage areas on the walls of the conduit.

d. Downstream Channel

The downstream channel is in the natural stream channel of the Dry River. While some minor debris (primarily dead trees) was observed in the immediate channel, the channel appears to be of adequate capacity to discharge the outflow from the conduit.

e. Reservoir

Sedimentation was observed in the vicinity of the intake tower. Due to the steep slopes of the upstream area sedimentation is a continuing problem, which must be periodically addressed.

f. Reservoir Drain

There is no separate reservoir drain. Under normal operating conditions, the water level in the upstream area is approximated by the ground level intake of the tower.

3.2 EVALUATION OF OBSERVATIONS

The problem areas observed during the inspection and the recommended remedial actions are as follows:

1. Erosion of the soil near the abutment contacts of the downstream face was observed. Monitor this erosion and repair as required.

2. Seepage and slight deterioration of the horseshoe conduit concrete was noted. Repair the affected areas to prevent further deterioration.

3. Debris and sediment was observed in the vicinity of the intake tower and the immediate downstream channel. Periodically remove this material.

4. Extensive tree and brush growth was noted on the surfaces of the embankment and the abutment areas. Remove this vegetation and provide a program of periodic cutting and mowing of these surfaces.

5. Provide a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also develop an emergency action plan for notification of downstream residents and the proper governmental authorities.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 Procedures

The normal water surface is approximated by the low stage inlet of the intake tower, the result being that little water is impounded on the upstream side of the structure. All flows are discharged through the intake tower.

4.2 Maintenance of the Dam

Maintenance of the dam is provided by the owner, the City of Watervliet, N.Y. Maintenance is not considered satisfactory as evidenced by the tree and brush growth, seepage in the horseshoe conduit, erosion and the downstream abutment contacts, and debris at the intake and downstream channel.

4.3 Warning System

There is no warning system in effect or in preparation.

4.4 Evaluation

The dam and appurtenances have been maintained in unsatisfactory condition as noted in "Section 3: Visual Inspection".

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Drainage Area Characteristics

The Watervliet Upper Dam is located on Dry River, tributary to the lower Hudson. The total area of the watershed at the dam is 2.88 square miles. The drainage paths are well defined, but the slopes are moderate. Some of the area is developed.

5.2 Analysis Criteria

The analysis of the spillway capacity of the dam and storage of the reservoir was performed using the Corps of Engineers HEC-1 computer model. The unit hydrograph was defined by the Snyder Synthetic Unit Hydrograph method, and the Modified Puls routing procedure was incorporated. The Probable Maximum Precipitation (PMP) was 20.5 inches (24 hrs., 200 sq. miles) from Hydrometerological Report #33 in accordance with recommended guidelines of the Corps of Engineers. Several floods were selected for analysis including 50% and 100% of the Probable Maximum Flood (PMF). The PMF inflow of 5828 cfs. was routed through the reservoir, resulting in a 5377 cfs outflow.

5.3 Spillway Capacity

The spillway is a tower type intake with a modified horseshoe outlet conduit. The intake consists of a 24 inch orifice into the conduit. The spillway crest elevation is at the toe of embankment resulting in no normal storage capacity, but high head allowable before overtopping occurs. There is another 18 " inlet to the conduit which is closed off at this time and assumed so for the analysis. The maximum capacity of the spillway at top of dam is 272 cfs.

5.4 Reservoir Capacity

The reservoir capacity, as previously stated, is 0.0 acre feet at spillway crest and 1217.0 acre feet at top of dam. Surcharge storage between spillway and top of dam is equivalent to 7.92 inches of runoff.

5.5 Floods of Record

There are no gaging stations on Dry River nor are there any accounts of high flows or levels.

5.6 Overtopping Potential

The maximum capacity of the spillway before overtopping occurs is 272 cfs. This combined with the large amount of surcharge storage available the dam will attenuate 55% of the PMF. The maximum outflow at 1/2 the PMF will be 270 cfs. The dam will be overtopped by 2.3 feet during the full PMF event.

5.7 Evaluation

The Watervliet Upper Dam will safely pass 55% of the PMF. By the Corps of Engineers Screening Criteria, it is considered inadequate.

SECTION 6: STRUCTIONAL STABILITY

6.1 Evaluation of Structional Stability

a. Visual Observations

No signs of major distress were observed in connection with the earth embankment. The embankment is not considered to be unstable.

b. Design and Construction Data

No design or construction data could be located concerning the slope stability of the embankment.

c. Post Construction Changes

No post construction changes were instituted.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I Inspection of Watervliet Upper Dam did not reveal any conditions which constitute a hazard to human life or property. The embankment is not condisered to be unstable. The dam, has a number of problem areas which require remedial attention.

b. Adequacy of Information

The information reviewed is considered adequate for Phase I Inspection purposes.

c. Need for Additional Investigation

No further investigation is required at this time.

d. Urgency

The areas listed below requiring remedial action should be initiated within 3 months and completed within 1 year from notification to the owner.

7.2 RECOMMENDATIONS

1. Monitor the erosion observed at the abutment contacts of the downstream slope and repair as required.

2. Repair the seeping and deteriorated concrete surfaces of the horseshoe conduit.

3. Periodically remove the debris from the vicinity of the intake tower and the downstream channel.

4. Remove the tree and brush growth from the embankment abutments. Provide a program of periodic cutting and mowing of these surfaces.

5. Provide a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference.

6. An emergency action plan must be developed.

APPENDIX A

PHOTOGRAPHS

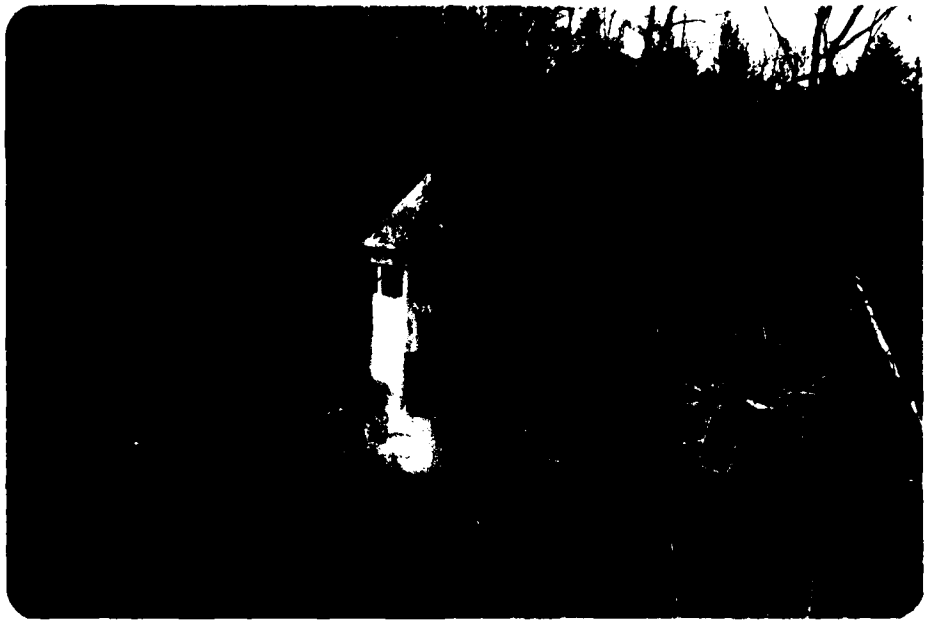


Photo # 2
Tower intake of the spillway.

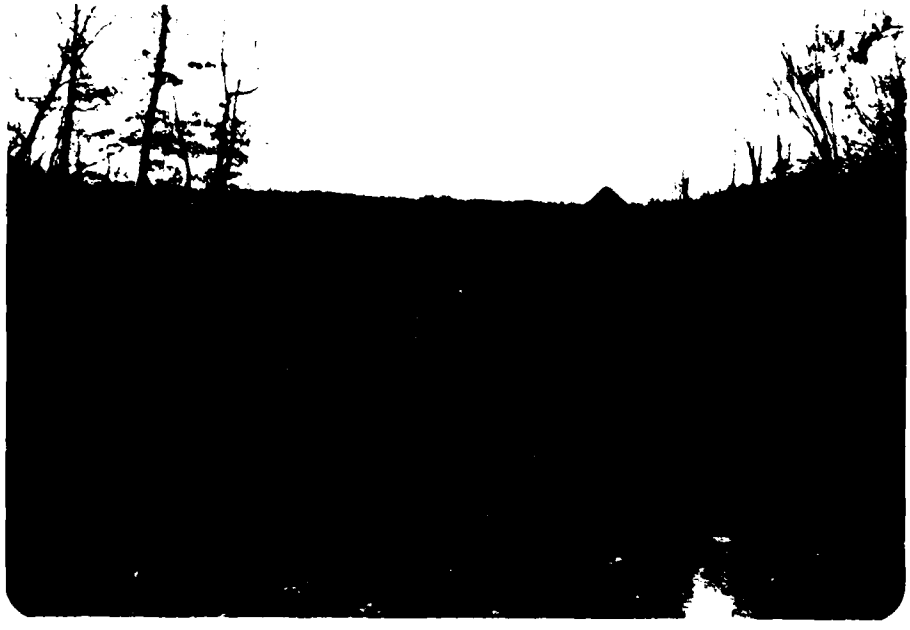


Photo # 3
View of the tower intake and upstream slope of the embankment
Note: Debris around low level orifice

Photo # 4
View of the 24" orifice from the tower into the conduit.

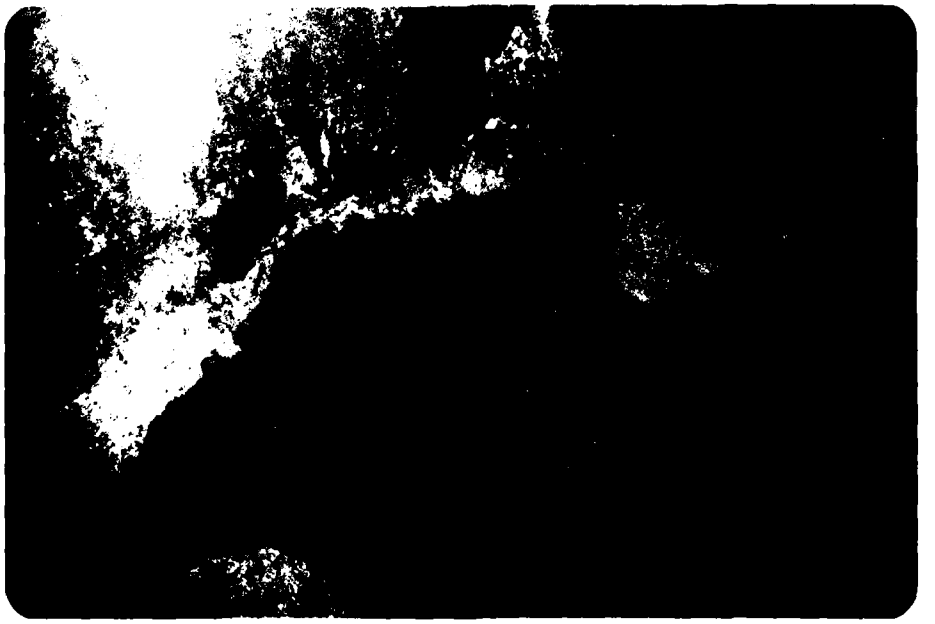


Photo # 5
Pitting of the concrete and seepage in the conduit.

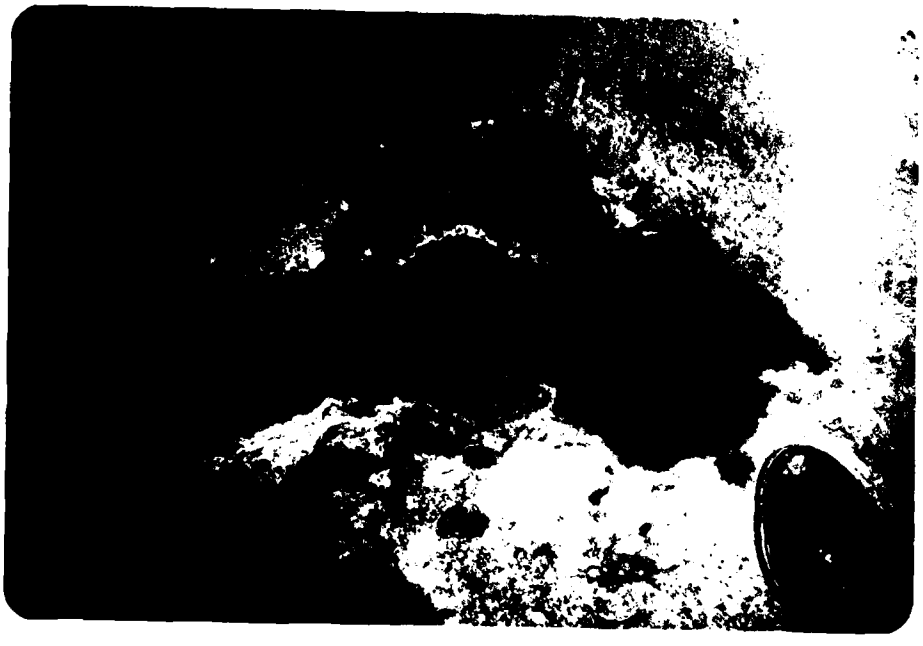


Photo # 6
Pitting and Seepage in the conduit.

Photo #7
Weep hole in the conduit.

Photo # 8
Outlet of horseshoe conduit.
Note bedrock outcrop.

Photo # 9
Downstream Channel.

APPENDIX B

VISUAL INSPECTION CHECKLIST

93-15-3(9/80)

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam WATERVLIET UPPER DAM

Fed. I.D. # NY 1356 DEC Dam No. 226A-1407

River Basin LOWER HUDSON RIVER

Location: Town Colonie County ALBANY

Stream Name DRY RIVER

Tributary of Lower Hudson

Latitude (N) 42°44.5' Longitude (W) 73°43.1'

Type of Dam EARTH

Hazard Category High

Date(s) of Inspection Nov. 7, 1980

Weather Conditions cloudy, 40's

Reservoir Level at Time of Inspection INVert of spillway

b. Inspection Personnel R. McCARTY, J. Veitch, R. DURRIN
J. DAVIN

c. Persons Contacted (Including Address & Phone No.) JIM DAVIN
SUPT. D.P.W.
CITY HALL
WATERVLIET NY
(518) 270-3821

d. History:

Date Constructed 1912 Date(s) Reconstructed

Designer Solomon Norcross & Keis

Constructed By Leary & Morrison Co.

Owner CITY OF WATERVLIET

93-15-3(9/80)

2) Embankment

a. Characteristics

(1) Embankment Material earth

(2) Cutoff Type

(3) Impervious Core concrete (6")

(4) Internal Drainage System some weep holes into conduit

(5) Miscellaneous heavy growth over embankment

b. Crest

(1) Vertical Alignment good roadway causing some minor depressions & erosion

(2) Horizontal Alignment good

(3) Surface Cracks none apparent

(4) Miscellaneous

c. Upstream Slope

(1) Slope (Estimate) (V:H) 2 : 1

(2) Undesirable Growth or Debris, Animal Burrows heavy growth

(3) Sloughing, Subsidence or Depressions none

(4) Slope Protection No problem

(5) Surface Cracks or Movement at Toe none

d. Downstream Slope

(1) Slope (Estimate - V:H) 2:1

(2) Undesirable Growth or Debris, Animal Burrows heavy growth of brush & trees

(3) Sloughing, Subsidence or Depressions [redacted] slight erosion at d/s abutment contacts

(4) Surface Cracks or Movement at Toe none

(5) Seepage none

(6) External Drainage System (Ditches, Trenches; Blanket) —

(7) Condition Around Outlet Structure good, some debris

(8) Seepage Beyond Toe None evident

e. Abutments - Embankment Contact

93-15-3(9/80)

(1) Erosion at Contact some slight due to local runoff

(2) Seepage Along Contact none

3) Drainage System

a. Description of System as plans indicate some type of drainage on berms (not wet) small seeps along conduit

b. Condition of System working

c. Discharge from Drainage System small weep seeping < ½ gal/min.

4) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) none.

93-15-3(9/80)

5) Reservoir

a. Slopes stable, heavily wooded

b. Sedimentation around intake tower

c. Unusual Conditions Which Affect Dam [redacted] normally empty

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) lower dam deep channel through rock

b. Seepage, Unusual Growth no seepage

c. Evidence of Movement Beyond Toe of Dam none

d. Condition of Downstream Channel Some debris

7) Spillway(s) (Including Discharge Conveyance Channel)

a. General generally good some slight maintenance needed

b. Condition of Service Spillway good - cosmetic/preventative maintenance needed

c. Condition of Auxiliary Spillway N/A

d. Condition of Discharge Conveyance Channel —

8) Reservoir Drain/Outlet primary spillway ✓

Type: Pipe _____ Conduit _____ Other _____

Material: Concrete ✓ Metal _____ Other _____

Size: 3' RAD. Modified horseshoe Length 440'

Invert Elevations: Entrance 135.5 Exit 130.

Physical Condition (Describe): relatively good Unobservable _____

Material: concrete some pitting

Joints: vecault Alignment good

Structural Integrity: good

Hydraulic Capability: wier control

Means of Control: Gate _____ Valve _____ Uncontrolled ✓

Operation: Operable _____ Inoperable _____ Other _____

Present Condition (Describe): good - debris

9) Structural

a. Concrete Surfaces good

b. Structural Cracking none

c. Movement - Horizontal & Vertical Alignment (Settlement) none

d. Junctions with Abutments or Embankments little erosion

e. Drains - Foundation, Joint, Face working

f. Water Passages, Conduits, Sluices good

g. Seepage or Leakage some through weeps and into conduit

h. Joints - Construction, etc. good

i. Foundation good

j. Abutments good

k. Control Gates n/a

l. Approach & Outlet Channels approach - heavy sediment & debris

m. Energy Dissipators (Plunge Pool, etc.) n/a rock

n. Intake Structures good

o. Stability good

p. Miscellaneous

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition —

11) Operation Procedures (Lake Level Regulation):

No operation req'd.

APPENDIX C

HYDROLOGIC / HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	215.	~50.	1217.
2) Design High Water (Max. Design Pool)	—	—	—
3) Auxiliary Spillway Crest	—	—	—
4) Pool Level with Flashboards	—	—	—
5) Service Spillway Crest	145	0.	0.

DISCHARGES

	Volume (cfs)
1) Average Daily	2.
2) Spillway @ Maximum High Water	272.
3) Spillway @ Design High Water	—
4) Spillway @ Auxiliary Spillway Crest Elevation	—
5) Low Level Outlet MAX.	272.
6) Total (of all facilities) @ Maximum High Water T+D.	272.
7) Maximum Known Flood	—
8) At Time of Inspection	~1.

CREST: ELEVATION: 215.

Type: compacted earth

Width: 20 Length: 500

Spillover —

Location N/A

SPILLWAY:

SERVICE		AUXILIARY
145.	Elevation	
Concrete tower intake.	Type	
—	Width	
	Type of Control	
✓	Uncontrolled	
	Controlled:	
24" ORIFICE	Type (Flashboards; gate)	
—	Number	
—	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
440' Conduit	Chute Length	
Same el. 145.	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : None

Location: —

Records:

Date - —

Max. Reading - —

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

No control.

DRAINAGE AREA: 2.88

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: some residential development

Terrain - Relief: moderate slope, well defined channel

Surface - Soil: low perm - some rock outcrop.

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

future development possible

Potential Sedimentation problem areas (natural or man-made; present or future)

Sediment problem now - normal maintenance would solve problem.

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

ND

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

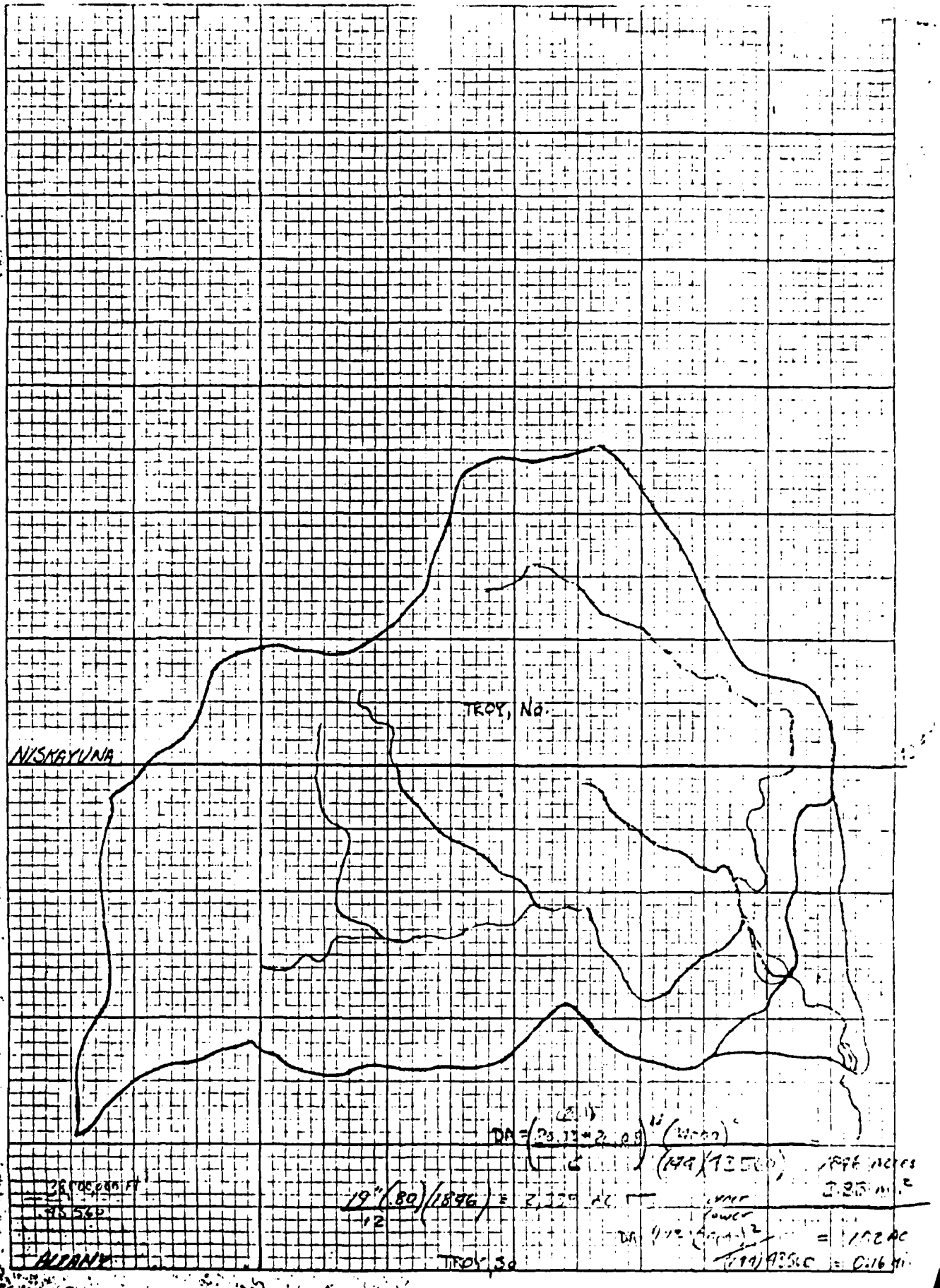
Location: none

Elevation:

Reservoir:

Length @ Maximum Pool 4000' ~~(Miles)~~

Length of Shoreline (@ Spillway Crest) ND ~~(Miles)~~


TROY, NY.
NISKAYUNA
ALBANY
TROY, NY

WATERVLIET UPPER & LOWER DAMS.

$L = \frac{7.6''}{12}\frac{(\ldots)}{(\ldots)} = 2.96$ mi.

L_{ca} = [illegible] = 1.25

[illegible] = 2.0 → 1.6 [illegible] elongation

$t_p = C_t(L \times L_{ca})^{0.3} = 2.35$ hr

t_r = [illegible] hr say 0.40 hr.

$T_p = t_p + .5t_r = 2.35 + 0.20 = 2.55$ hr.

C_p = 0.675

[illegible] { 24 [illegible] thru tower [illegible] $A = 3.14$ FT.[2]
[illegible] { 15 [illegible] [illegible] to [illegible]

[illegible] 142 C [illegible] - .60 $Q = CA\sqrt{2gh}$

[illegible]	Q TOTAL (cfs)	C	h	STORAGE ([illegible])
[illegible]	20	.6	2	7
	91	↓	7	[illegible]
	119		12	[illegible]
	140		17	[illegible]
	175		27	64.3
	203		37	[illegible]
	226		47	[illegible]
	[illegible]		57	561.3
	267		67	960.[illegible]

[illegible] 215.0' L = 500.' C = 3.0

[illegible] LOWER

DA = 102 ACRES
= 0.16 mi²

$L = 20''\left(\frac{[illegible]}{(12)5280}\right) = 0.75$ mi

$L_{ca} = 0.65''\left(\frac{24000}{(12)5280}\right) = 0.25$ mi.

$C_t = 2.0$

$t_p = 1.2$ hr

$t_r = 0.2$ hr T_p [illegible] = 1.3 hr.

$C_p = 0.[illegible]5$

TOP OF DAM ELEV. = 111.5 C = 3.2
SPILLCREST = 106.0 L = 70.3'
h = [illegible] ogee section & C = 3.[illegible]
[illegible] C = 6 Total abutment L @ 111.5 = 22 + 15.5 = [illegible]

[illegible]			Q			STORAGE AC.FT.			
[illegible]	[illegible]		[illegible]	[illegible]	TOTAL	$10^6 ft^3$	ac ft		ACTIVE
	-	-	-	use 70.0 [illegible]		.19	4.4	sediment	0
		-				.40	9.2	sediment	0
		-	21.		21	.48	11.0		1.8
		-	30.		30	.58	13.3		4.1
			[illegible]		37	.72	16.5		7.3
		-	43.		43	.90	20.7		11.5
		-	49.		49	1.12	25.7		16.5
			53.		[illegible]	1.37	31.5		22.3
		-	57.	-	57	1.66	39.1		28.9
		2	60.	713	773	2.01	46.1		36.9
		4	69.	2013	2080	2.42	55.[illegible]		[illegible]
			[illegible]	[illegible]	[illegible]	3.45	79.[illegible]		[illegible]

RAINFALL Σ DMP = 20.55

Dur.	6	12	24	48
%	111	123	133	142

```
**********                                                    **********
FLOOD HYDROGRAPH PACKAGE (HEC-1)                              NEW YORK STATE
DAM SAFETY VERSION     JULY 1978                              DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION  26 FEB 79                                FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL APR 79
**********                                                    **********
    1          A1  INFLOW -OUTFLOW UPPER RESERVOIR
    2          A2  WATERVLIET STORM DETENTION
    3          A3  8DEC1980
    4          B    200       0      15       0       0       0       0       0       0       0
    5          B1     5
    6          J      1       6       1
    7          J1    .2      .4      .5      .6      .8       1
    8          K              1                       2               1
    9          K1  INFLOW FROM SUB-BASIN
   10          M      1       1    2.88            2.96
   11          P             20.5     111     123     133     142
   12          T                                                1.0     0.1
   13          W   2.55     .625
   14          X     -2       2       1
   15          K      1       1                       2               1
   16          K1  ROUTED HYDROGRAPH AT UPPER RESERVOIR
   17          Y                              1       1
   18          Y1     1                                        -143      -1
   19          Y4  143      145     150     155     160     170     180     190     200     210
   20          Y5            20      91     119     140     178     203     226     258     267
   21          S5             7    10.3    18.4    28.7    64.3   128.6   251.4   507.3   980.3
   22          SE  143      145     150     155     160     170     180     190     200     210
   23          S9  143
   24          SD  215       3     1.5     500
   25          K      0       2                                       1
   26          K1  INFLOW FROM LOWER SUBBASIN
   27          M      1       1     .16            2.96
   28          P             20.5     111     123     133     142
   29          T                                                1.0     0.1
   30          W   1.3     .625
   31          X     -2       2       1
```

```
K      1      3                                         1
KĪ  RCUTE TOTAL RUNOFF THROUGH LOWER RESERVOIR
Y                          1      1
Y1     1                                            -92.      -1
Y4    92     94     96     98    100    102    1C4    106    108    110
Y4   115
Y5           21     30     37     43     48     53     57    773   2080
Y5  6877
$S          1.8    4.1    7.3   11.5   16.5   22.3   28.9   36.9   46.4
$S  70.C
$E    92     94     96     98    100    102    104    106    108    110
$E   115
$$    92
$D 111.5    3.2    1.5     38
K     99
A
A
A
A
A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	1
RUNOFF HYDROGRAPH AT	2
COMBINE 2 HYDROGRAPHS AT	3
ROUTE HYDROGRAPH TO	3

END OF NETWORK

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  MODIFIED FOR HONEYWELL APR 79
**********

**********
NEW YORK STATE
DEPT OF ENVIRONMENTAL CONSERVATION
FLOOD PROTECTION BUREAU
**********

RUN  DATE 12/08/80

                    INFLOW -OUTFLOW UPPER RESERVOIR

                    8DEC1980

                                JOB SPECIFICATION
      NC      NHR     NMIN     IDAY     IHR     IMIN    METRC     IPLT     IPRT    NSTAN
     200        0       15        0       0        0        0        0        0        0
                         JOPER      NWT    LROPT    TRACE
                             5        0        0        0


                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 6 LRTIO= 1
                RTIOS=   0.20   0.40   0.50   0.60   0.80   1.00

**********          **********          **********          **********          **********

                                SUB-AREA RUNOFF COMPUTATION

                INFLOW FROM SUB-BASIN
                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                              1       0       0       0       2       0       1       0       0

                                HYDROGRAPH DATA
                IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                    1       1    2.88      0.    2.96      0.      0.          0       0       0

                                PRECIP DATA
                          SPFE     PMS      R6     R12     R24     R48     R72     R96
                            0.   20.50  111.00  123.00  133.00  142.00     0.      0.
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                LOSS DATA
                LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                    0      0.      0.    1.00      0.      0.    1.00    1.00    0.10      0.      0.

                                UNIT HYDROGRAPH DATA
                            TP=  2.55    CP=0.63    NTA=  0

                                RECESSION DATA
                          STRTQ=   -2.00    QRCSN=    2.00    RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=11.21 AND R= 9.39 INTERVALS

                UNIT HYDROGRAPH 56 END-OF-PERIOD ORDINATES, LAG=  2.54 HOURS, CP= 0.63  VOL= 1.00
                  14.      53.     107.     169.     237.     307.     371.     420.     454.     470.
                 468.     440.     396.     356.     320.     288.     259.     233.     209.     188.
                 169.     152.     137.     123.     110.      99.      89.      80.      72.      65.
                  58.      52.      47.      42.      38.      34.      31.      28.      25.      22.
                  20.      18.      16.      15.      13.      12.      11.      10.       9.       8.
                   7.       6.       6.       5.       5.       4.

      0                         END-OF-PERIOD FLOW
    MO.DA  HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q      MO.DA  HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q
     1.01   0.15       1    0.00      0.    0.00          6.       1.02   1.15     101    0.03    0.00    0.03         14.
```

1.01	0.45	3	0.00	0.	0.00	6.	1.02	1.45	103	0.03	0.00	0.03	14.
1.01	1.00	4	0.00	0.	0.00	6.	1.02	2.00	104	0.03	0.00	0.03	14.
1.01	1.15	5	0.00	0.	0.00	6.	1.02	2.15	105	0.03	0.00	0.03	15.
1.01	1.30	6	0.00	0.	0.00	6.	1.02	2.30	106	0.03	0.00	0.03	16.
1.01	1.45	7	0.00	0.	0.00	6.	1.02	2.45	107	0.03	0.00	0.03	16.
1.01	2.00	8	0.00	0.	0.00	6.	1.02	3.00	108	0.03	0.00	0.03	17.
1.01	2.15	9	0.00	0.	0.00	6.	1.02	3.15	109	0.03	0.00	0.03	18.
1.01	2.30	10	0.00	0.	0.00	6.	1.02	3.30	110	0.03	0.00	0.03	18.
1.01	2.45	11	0.00	0.	0.00	6.	1.02	3.45	111	0.03	0.00	0.03	19.
1.01	3.00	12	0.00	0.	0.00	6.	1.02	4.00	112	0.03	0.00	0.03	19.
1.01	3.15	13	0.00	0.	0.00	6.	1.02	4.15	113	0.03	0.00	0.03	20.
1.01	3.30	14	0.00	0.	0.00	6.	1.02	4.30	114	0.03	0.00	0.03	20.
1.01	3.45	15	0.00	0.	0.00	6.	1.02	4.45	115	0.03	0.00	0.03	20.
1.01	4.00	16	0.00	0.	0.00	6.	1.02	5.00	116	0.03	0.00	0.03	21.
1.01	4.15	17	0.00	0.	0.00	6.	1.02	5.15	117	0.03	0.00	0.03	21.
1.01	4.30	18	0.00	0.	0.00	6.	1.02	5.30	118	0.03	0.00	0.03	21.
1.01	4.45	19	0.00	0.	0.00	6.	1.02	5.45	119	0.03	0.00	0.03	21.
1.01	5.00	20	0.00	0.	0.00	6.	1.02	6.00	120	0.03	0.00	0.03	21.
1.01	5.15	21	0.00	0.	0.00	6.	1.02	6.15	121	0.08	0.06	0.03	22.
1.01	5.30	22	0.00	0.	0.00	6.	1.02	6.30	122	0.08	0.06	0.03	25.
1.01	5.45	23	0.00	0.	0.00	6.	1.02	6.45	123	0.08	0.06	0.03	31.
1.01	6.00	24	0.00	0.	0.00	6.	1.02	7.00	124	0.08	0.06	0.03	40.
1.01	6.15	25	0.01	0.	0.01	6.	1.02	7.15	125	0.08	0.06	0.03	53.
1.01	6.30	26	0.01	0.	0.01	6.	1.02	7.30	126	0.08	0.06	0.03	70.
1.01	6.45	27	0.01	0.	0.01	6.	1.02	7.45	127	0.08	0.06	0.03	91.
1.01	7.00	28	0.01	0.	0.01	6.	1.02	8.00	128	0.08	0.06	0.03	114.
1.01	7.15	29	0.01	0.	0.01	6.	1.02	8.15	129	0.08	0.06	0.03	139.
1.01	7.30	30	0.01	0.	0.01	6.	1.02	8.30	130	0.08	0.06	0.03	164.
1.01	7.45	31	0.01	0.	0.01	6.	1.02	8.45	131	0.08	0.06	0.03	190.
1.01	8.00	32	0.01	0.	0.01	6.	1.02	9.00	132	0.08	0.06	0.03	214.
1.01	8.15	33	0.01	0.	0.01	6.	1.02	9.15	133	0.08	0.06	0.03	236.
1.01	8.30	34	0.01	0.	0.01	6.	1.02	9.30	134	0.08	0.06	0.03	255.
1.01	8.45	35	0.01	0.	0.01	6.	1.02	9.45	135	0.08	0.06	0.03	273.
1.01	9.00	36	0.01	0.	0.01	6.	1.02	10.00	136	0.08	0.06	0.03	289.
1.01	9.15	37	0.01	0.	0.01	6.	1.02	10.15	137	0.08	0.06	0.03	303.
1.01	9.30	38	0.01	0.	0.01	6.	1.02	10.30	138	0.08	0.06	0.03	316.
1.01	9.45	39	0.01	0.	0.01	6.	1.02	10.45	139	0.08	0.06	0.03	327.
1.01	10.00	40	0.01	0.	0.01	6.	1.02	11.00	140	0.08	0.06	0.03	338.
1.01	10.15	41	0.01	0.	0.01	6.	1.02	11.15	141	0.08	0.06	0.03	347.
1.01	10.30	42	0.01	0.	0.01	6.	1.02	11.30	142	0.08	0.06	0.03	355.
1.01	10.45	43	0.01	0.	0.01	6.	1.02	11.45	143	0.08	0.06	0.03	363.
1.01	11.00	44	0.01	0.	0.01	6.	1.02	12.00	144	0.08	0.06	0.03	369.
1.01	11.15	45	0.01	0.	0.01	6.	1.02	12.15	145	0.46	0.43	0.02	381.
1.01	11.30	46	0.01	0.	0.01	6.	1.02	12.30	146	0.46	0.43	0.02	406.
1.01	11.45	47	0.01	0.	0.01	6.	1.02	12.45	147	0.46	0.43	0.02	451.
1.01	12.00	48	0.01	0.	0.01	6.	1.02	13.00	148	0.46	0.43	0.02	518.
1.01	12.15	49	0.03	0.	0.03	6.	1.02	13.15	149	0.55	0.52	0.02	612.
1.01	12.30	50	0.03	0.	0.03	6.	1.02	13.30	150	0.55	0.52	0.02	734.
1.01	12.45	51	0.03	0.	0.03	6.	1.02	13.45	151	0.55	0.52	0.02	886.
1.01	13.00	52	0.03	0.	0.03	6.	1.02	14.00	152	0.55	0.52	0.02	1061.
1.01	13.15	53	0.04	0.	0.04	6.	1.02	14.15	153	0.68	0.66	0.02	1256.
1.01	13.30	54	0.04	0.	0.04	6.	1.02	14.30	154	0.68	0.66	0.02	1469.
1.01	13.45	55	0.04	0.	0.04	6.	1.02	14.45	155	0.69	0.66	0.02	1694.
1.01	14.00	56	0.04	0.	0.04	6.	1.02	15.00	156	0.68	0.66	0.02	1921.
1.01	14.15	57	0.05	0.	0.05	6.	1.02	15.15	157	0.69	0.67	0.02	2144.
1.01	14.30	58	0.05	0.	0.05	6.	1.02	15.30	158	1.38	1.36	0.03	2374.
1.01	14.45	59	0.05	0.	0.05	6.	1.02	15.45	159	3.87	3.85	0.03	2661.
1.01	15.00	60	0.05	0.	0.05	6.	1.02	16.00	160	0.97	0.94	0.02	3032.
1.01	15.15	61	0.05	0.	0.05	6.	1.02	16.15	161	0.64	0.61	0.02	3455.
1.01	15.30	62	0.09	0.	0.09	6.	1.02	16.30	162	0.64	0.61	0.02	3900.
1.01	15.45	63	0.26	0.03	0.23	6.	1.02	16.45	163	0.64	0.61	0.02	4350.
1.01	16.00	64	0.07	0.04	0.03	8.	1.02	17.00	164	0.64	0.61	0.02	4788.
1.01	16.15	65	0.04	0.02	0.03	12.	1.02	17.15	165	0.50	0.48	0.02	5176.
1.01	16.30	66	0.04	0.02	0.03	17.	1.02	17.30	166	0.50	0.48	0.02	5481.

1.01	17.45	71	0.03	0.01	0.03	59.	1.02	18.45	171	0.04	0.02	0.03	5481.
1.01	18.00	72	0.03	0.01	0.03	67.	1.02	19.00	172	0.04	0.02	0.03	5227.
1.01	18.15	73	0.00	0.	0.00	73.	1.02	19.15	173	0.04	0.02	0.03	4949.
1.01	18.30	74	0.00	0.	0.00	77.	1.02	19.30	174	0.04	0.02	0.03	4648.
1.01	18.45	75	0.00	0.	0.00	79.	1.02	19.45	175	0.04	0.02	0.03	4327.
1.01	19.00	76	0.00	0.	0.00	78.	1.02	20.00	176	0.04	0.02	0.03	3996.
1.01	19.15	77	0.00	0.	0.00	77.	1.02	20.15	177	0.04	0.02	0.03	3663.
1.01	19.30	78	0.00	0.	0.00	73.	1.02	20.30	178	0.04	0.02	0.03	3335.
1.01	19.45	79	0.00	0.	0.00	69.	1.02	20.45	179	0.04	0.02	0.03	3020.
1.01	20.00	80	0.00	0.	0.00	65.	1.02	21.00	180	0.04	0.02	0.03	2728.
1.01	20.15	81	0.00	0.	0.00	60.	1.02	21.15	181	0.04	0.02	0.03	2464.
1.01	20.30	82	0.00	0.	0.00	55.	1.02	21.30	182	0.04	0.02	0.03	2228.
1.01	20.45	83	0.00	0.	0.00	50.	1.02	21.45	183	0.04	0.02	0.03	2015.
1.01	21.00	84	0.00	0.	0.00	46.	1.02	22.00	184	0.04	0.02	0.03	1824.
1.01	21.15	85	0.00	0.	0.00	42.	1.02	22.15	185	0.04	0.02	0.03	1652.
1.01	21.30	86	0.00	0.	0.00	38.	1.02	22.30	186	0.04	0.02	0.03	1497.
1.01	21.45	87	0.00	0.	0.00	35.	1.02	22.45	187	0.04	0.02	0.03	1358.
1.01	22.00	88	0.00	0.	0.00	32.	1.02	23.00	188	0.04	0.02	0.03	1233.
1.01	22.15	89	0.00	0.	0.00	29.	1.02	23.15	189	0.04	0.02	0.03	1121.
1.01	22.30	90	0.00	0.	0.00	27.	1.02	23.30	190	0.04	0.02	0.03	1020.
1.01	22.45	91	0.00	0.	0.00	25.	1.02	23.45	191	0.04	0.02	0.03	929.
1.01	23.00	92	0.00	0.	0.00	23.	1.03	0.	192	0.04	0.02	0.03	848.
1.01	23.15	93	0.00	0.	0.00	21.	1.03	0.15	193	0.	0.	0.	774.
1.01	23.30	94	0.00	0.	0.00	20.	1.03	0.30	194	0.	0.	0.	707.
1.01	23.45	95	0.00	0.	0.00	18.	1.03	0.45	195	0.	0.	0.	646.
1.02	0.	96	0.00	0.	0.00	17.	1.03	1.00	196	0.	0.	0.	591.
1.02	0.15	97	0.03	0.00	0.03	16.	1.03	1.15	197	0.	0.	0.	539.
1.02	0.30	98	0.03	0.00	0.03	15.	1.03	1.30	198	0.	0.	0.	491.
1.02	0.45	99	0.03	0.00	0.03	14.	1.03	1.45	199	0.	0.	0.	446.
1.02	1.00	100	0.03	0.00	0.03	14.	1.03	2.00	200	0.	0.	0.	405.
									SUM	23.29	19.59	3.70	143113.
										(592.)	(498.)	(94.)	(4052.51)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5828.	4251.	1469.	714.	142890.
CMS	165.	120.	42.	20.	4046.
INCHES		13.73	18.97	19.23	19.23
MM		348.77	481.95	488.45	488.45
AC-FT		2108.	2913.	2952.	2952.
THOLS CU M		2600.	3593.	3642.	3642.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FORMULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 0.20	RATIO 2 0.40	RATIO 3 0.50	RATIO 4 0.60	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1 (15091.13)	2.88	1	1166. (33.00)	2331. (66.01)	2914. (82.51)	3497. (99.01)	4662. (132.02)	5828. (165.02)
ROUTED TO	1 (15091.13)	2.88	1	241. (6.82)	265. (7.51)	270. (7.66)	1361. (38.54)	3588. (101.61)	5377. (152.25)
HYDROGRAPH AT	2 (15091.13)	0.16	1	92. (2.59)	183. (5.19)	229. (6.48)	275. (7.78)	366. (10.37)	458. (12.97)
2 COMBINED	3 (15091.13)	3.04	1	288. (8.14)	408. (11.55)	463. (13.12)	1380. (39.08)	3705. (104.91)	5629. (159.40)
ROUTED TO	3 (15091.13)	3.04	1	286. (8.11)	406. (11.49)	461. (13.05)	1373. (38.89)	3766. (106.64)	5827. (164.99)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	143.00	143.00	215.00
STORAGE	0.	0.	1217.
OUTFLOW	0.	0.	272.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	194.59	0.	369.	241.	0.	47.00	0.
0.40	207.98	0.	885.	265.	0.	48.75	0.
0.50	213.76	0.	1158.	270.	0.	49.25	0.
0.60	215.81	0.81	1255.	1361.	5.50	45.50	0.
0.80	216.70	1.70	1297.	3588.	7.25	43.75	0.
1.00	217.26	2.26	1324.	5377.	8.00	42.75	0.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	92.00	92.00	111.50
STORAGE	0.	0.	53.
OUTFLOW	0.	0.	3519.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	106.64	0.	31.	286.	0.	41.25	0.
0.40	106.97	0.	33.	406.	0.	41.25	0.
0.50	107.13	0.	33.	461.	0.	41.25	0.
0.60	108.92	0.	41.	1373.	0.	45.50	0.
0.80	111.74	0.24	55.	3766.	0.75	43.50	0.
1.00	113.54	2.04	63.	5827.	2.00	42.75	0.

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) U.S. Department of Commerce, Hydrometeorological Report No. 33, Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours; April 1956.

3) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

4) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

5) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

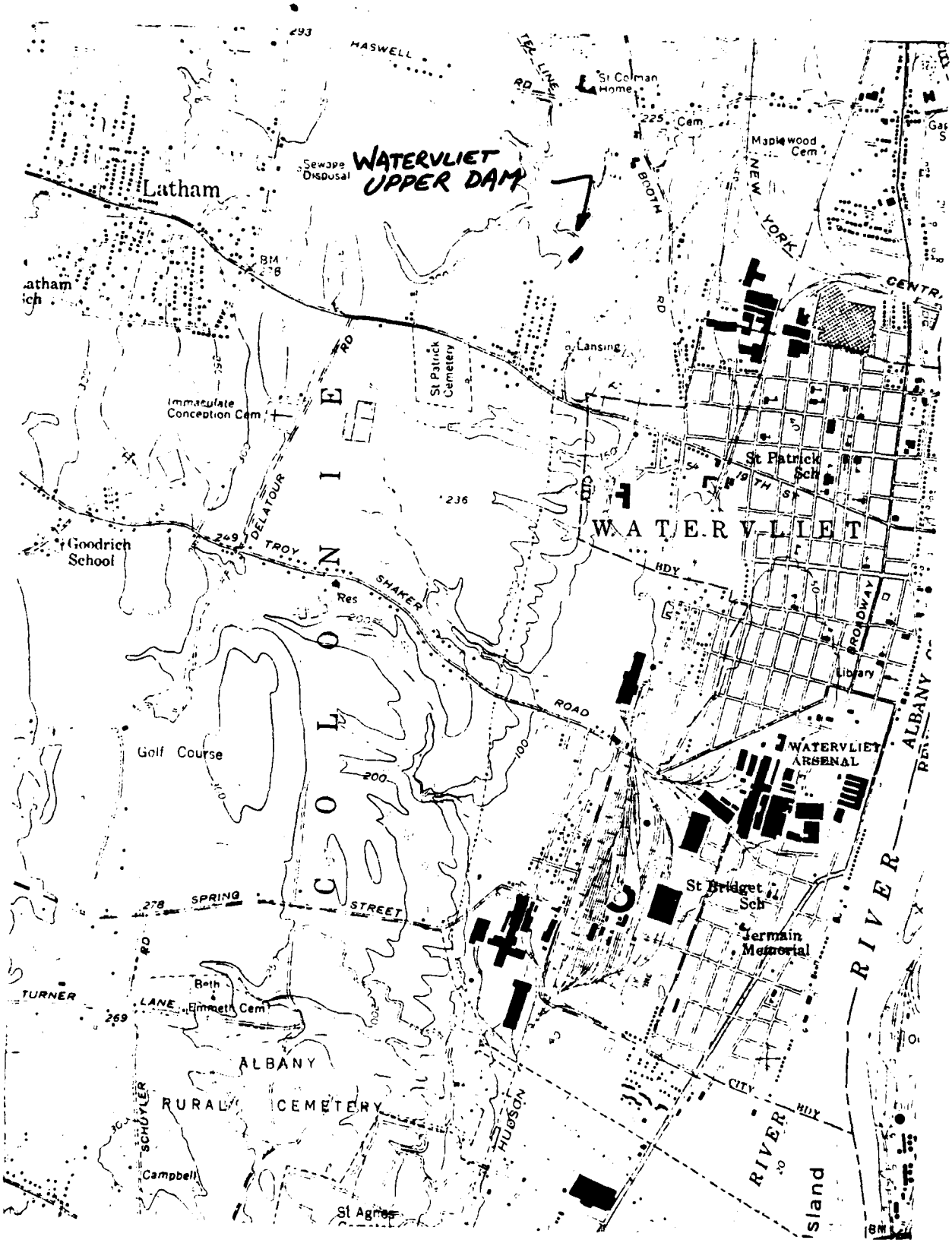
6) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

7) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

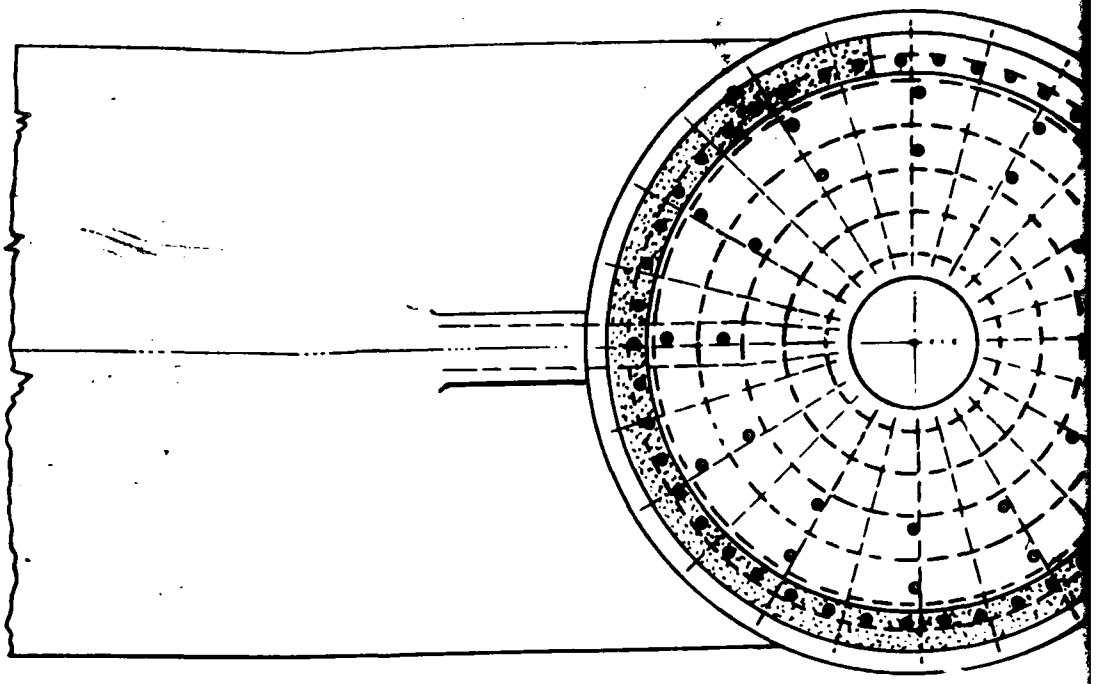
8) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX E

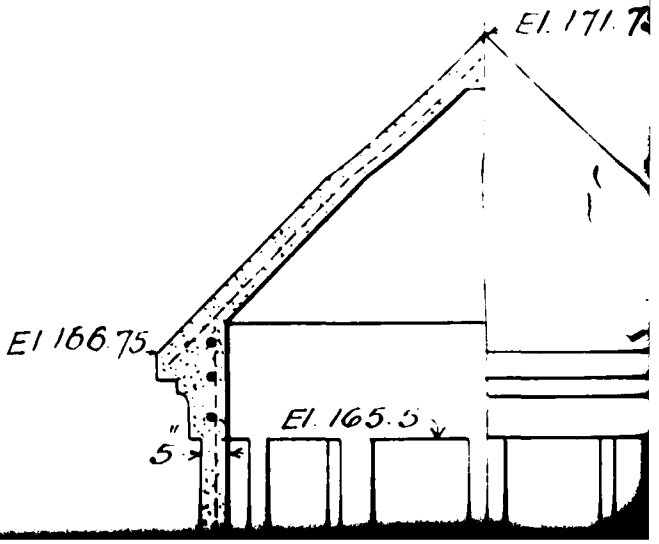
DRAWINGS



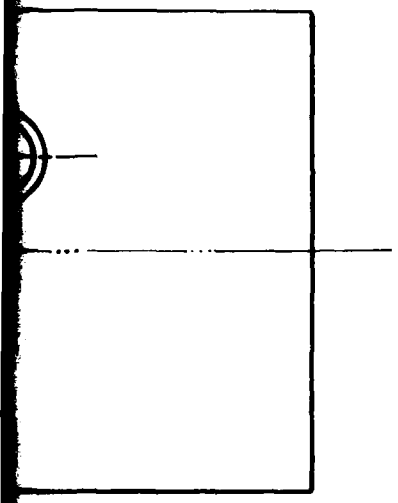
TOPOGRAPHIC MAP

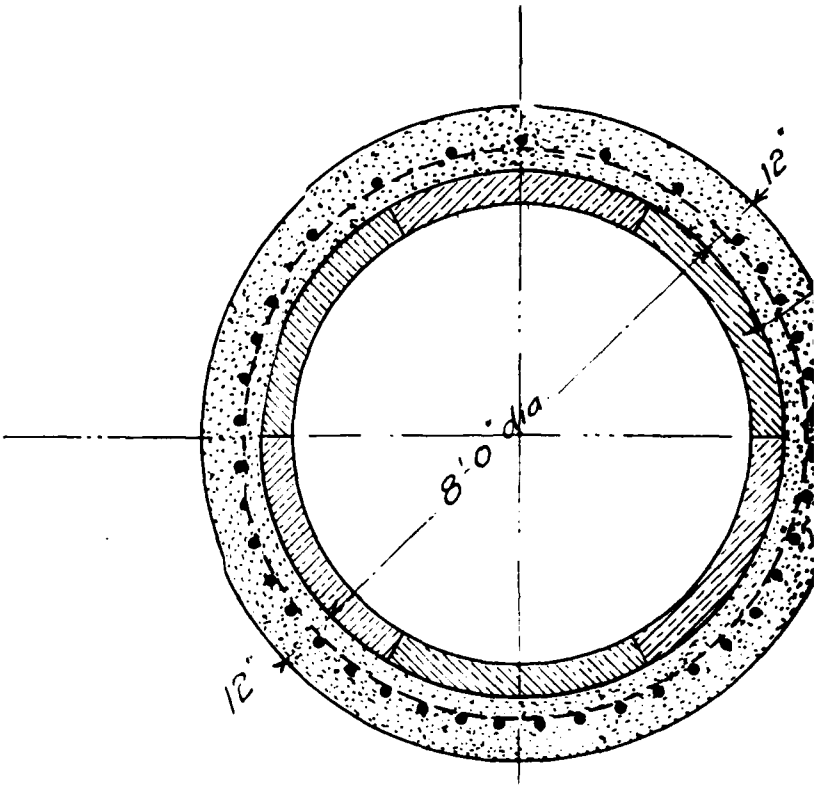


Section C-D



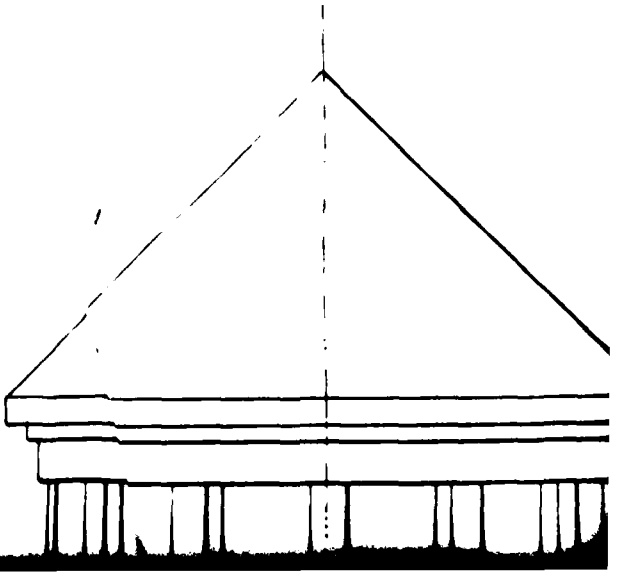
cement in Floor of Tower
vertically & horizontally

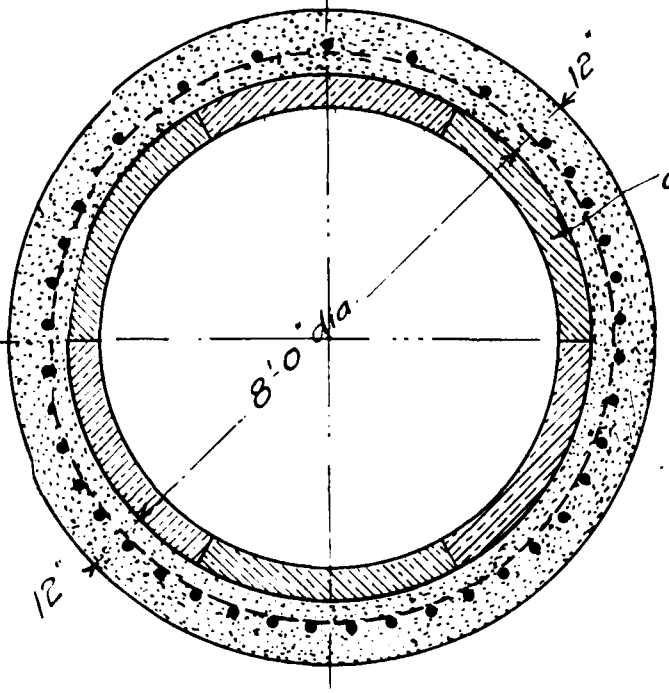




Section A-B

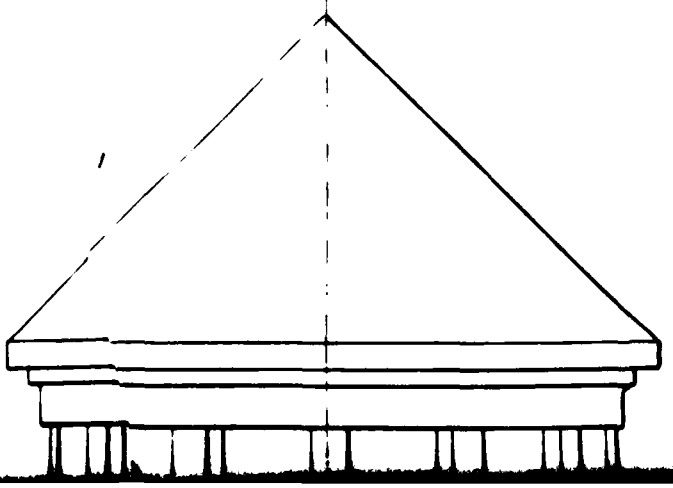
nforcement in Shell of Tower
al Bars $\frac{3}{4}$" sq.
Bars $\frac{5}{8}$" sq.

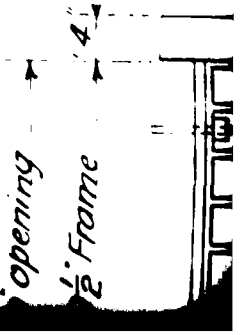


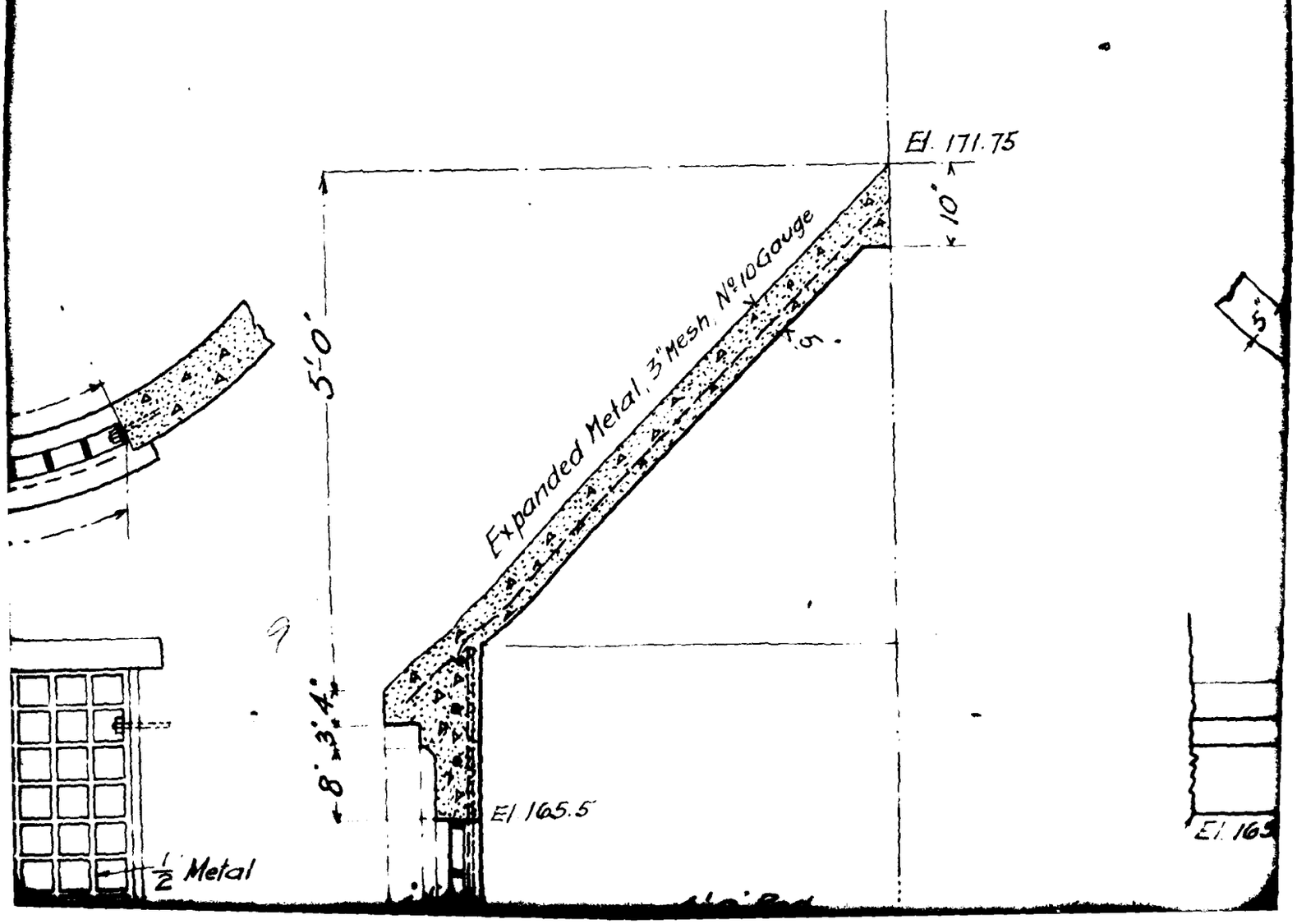


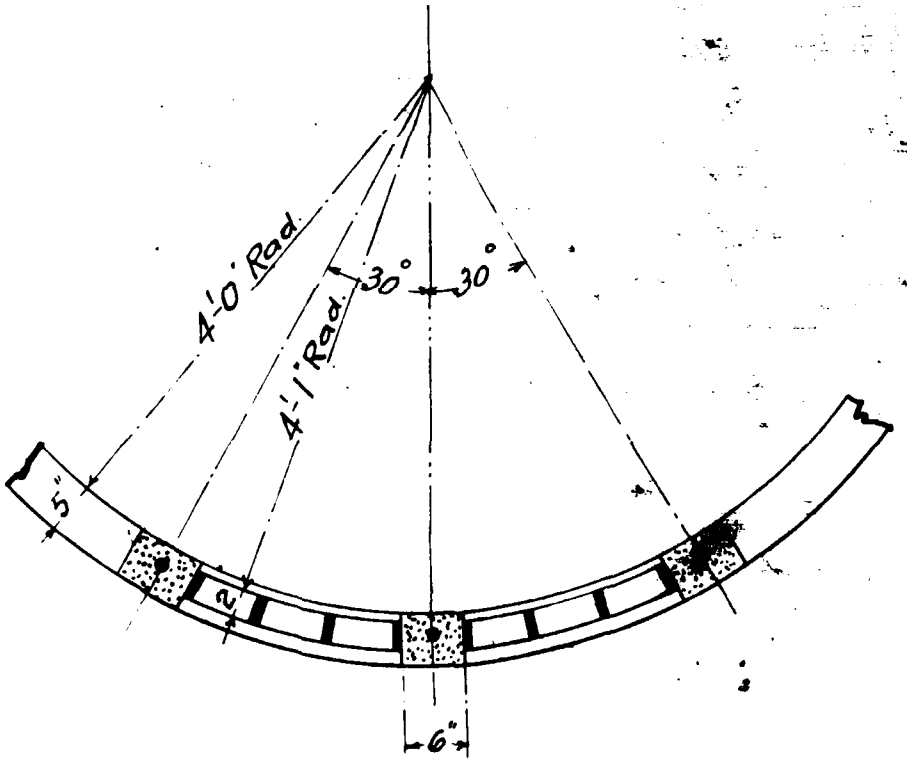
6" granite Curbing 3'-6" inside radius, dressed all over, except on back.

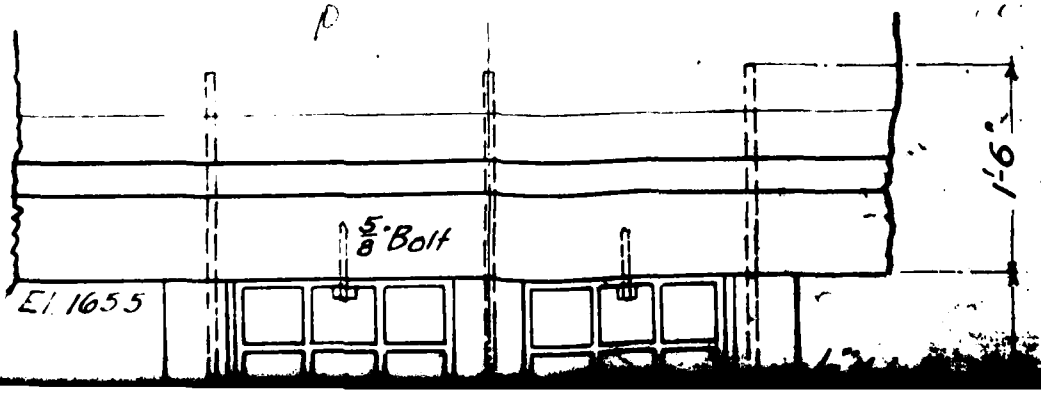
Section A-B

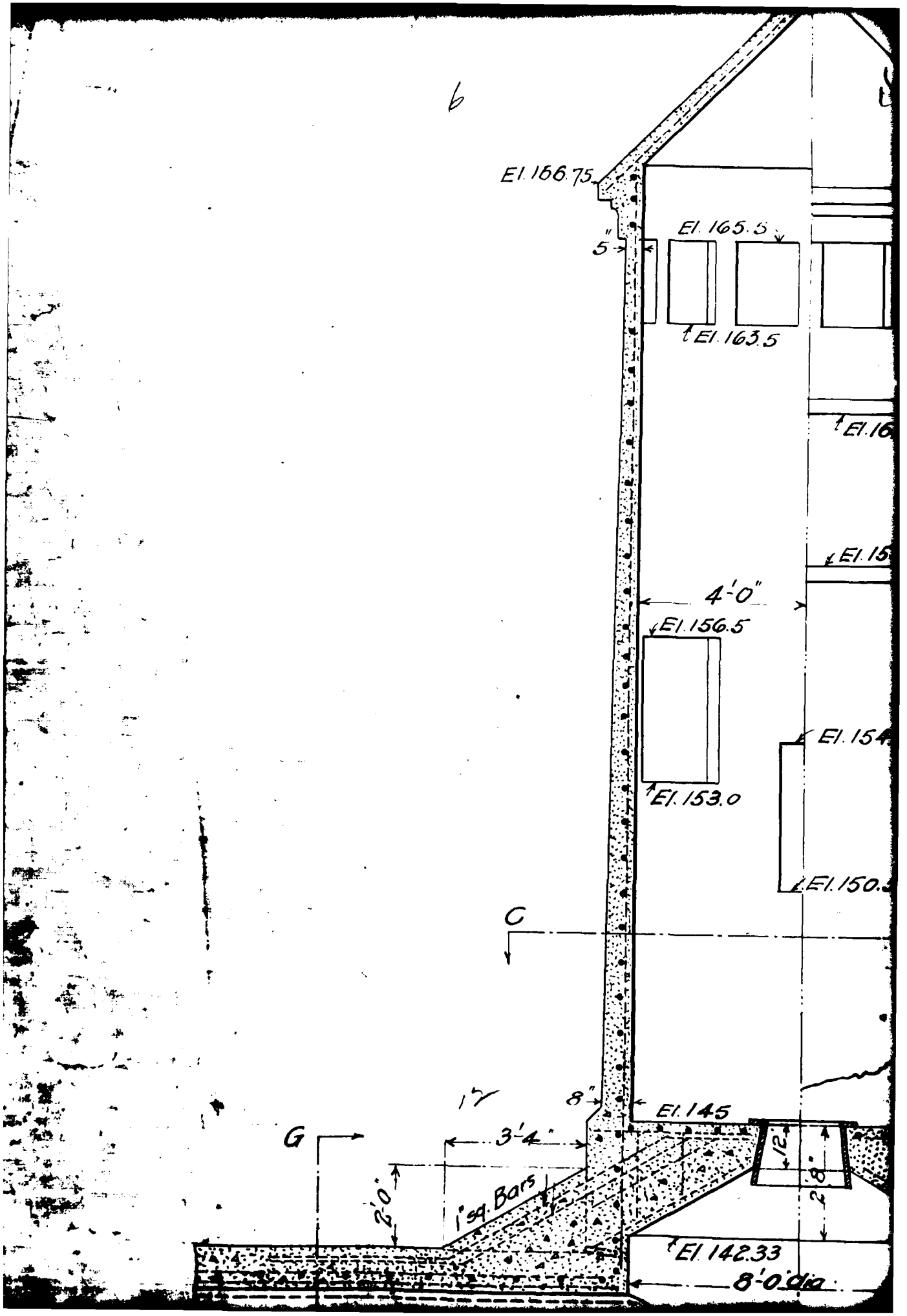


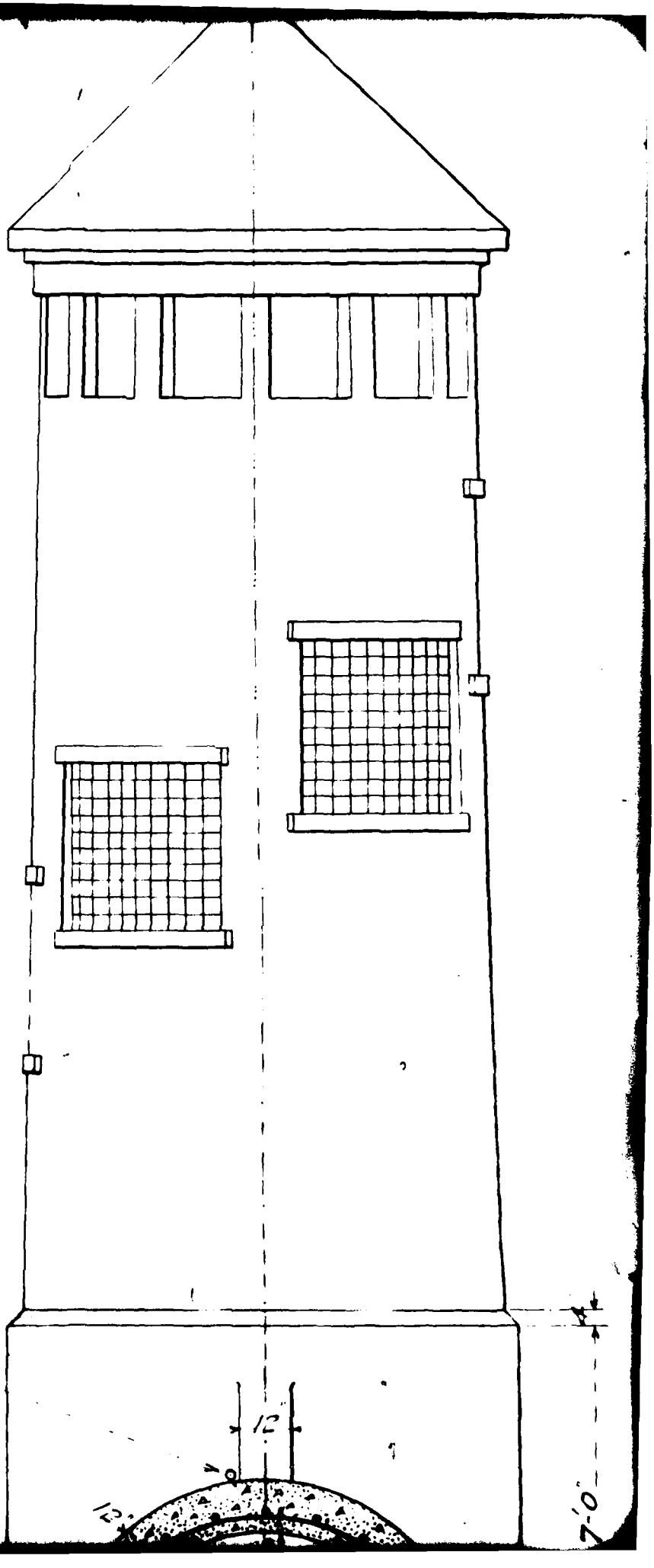



El. 171.75
10"
5'-0"
Expanded Metal, 3" Mesh, No 10 Gauge
5"
8'-3 1/4"
El 165.5
1/2" Metal
El 165


4'-0" Rad.
4'-1" Rad.
30°
30°
5"
2"
6"

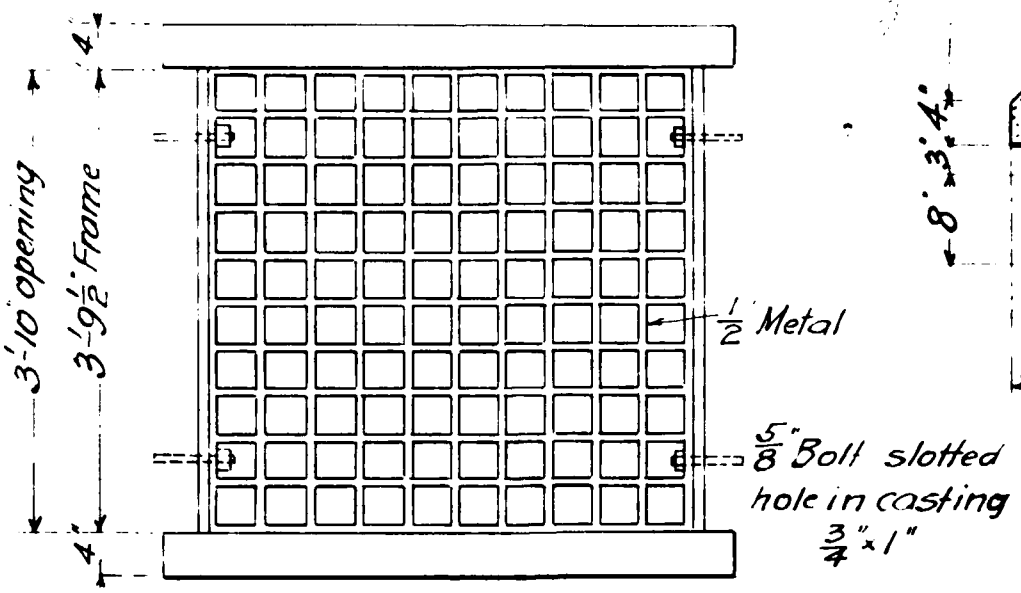

5/8" Bolt
El. 1655
1'-6"


El. 166.75
El. 165.5
5"
El. 163.5
El. 16
El. 15
4'-0"
El. 156.5
El. 154
El. 153.0
El. 150.
C
8"
El. 145
G
3'-4"
12"
28"
2'0"
1"sq. Bars
El. 142.33
8'-0 dia

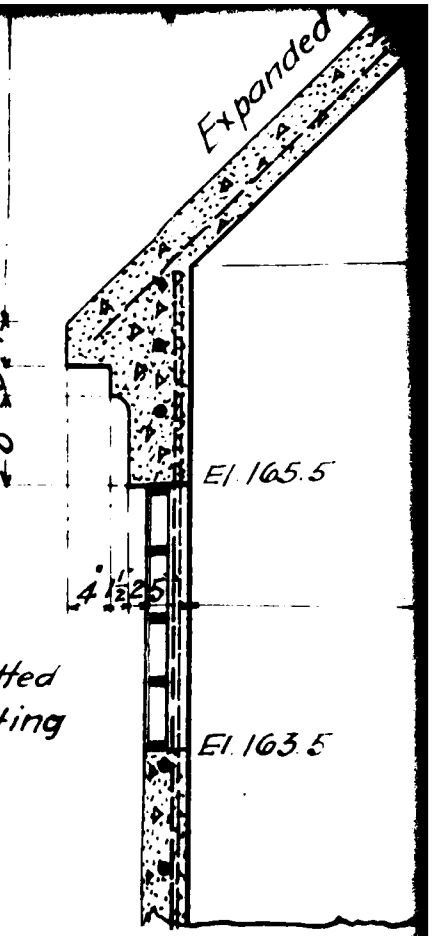


Vent hole for 2" galv. iron pipe. Pipe to be laid to drain into Tower.

panded Metal
3" Mesh, No 10 gauge.

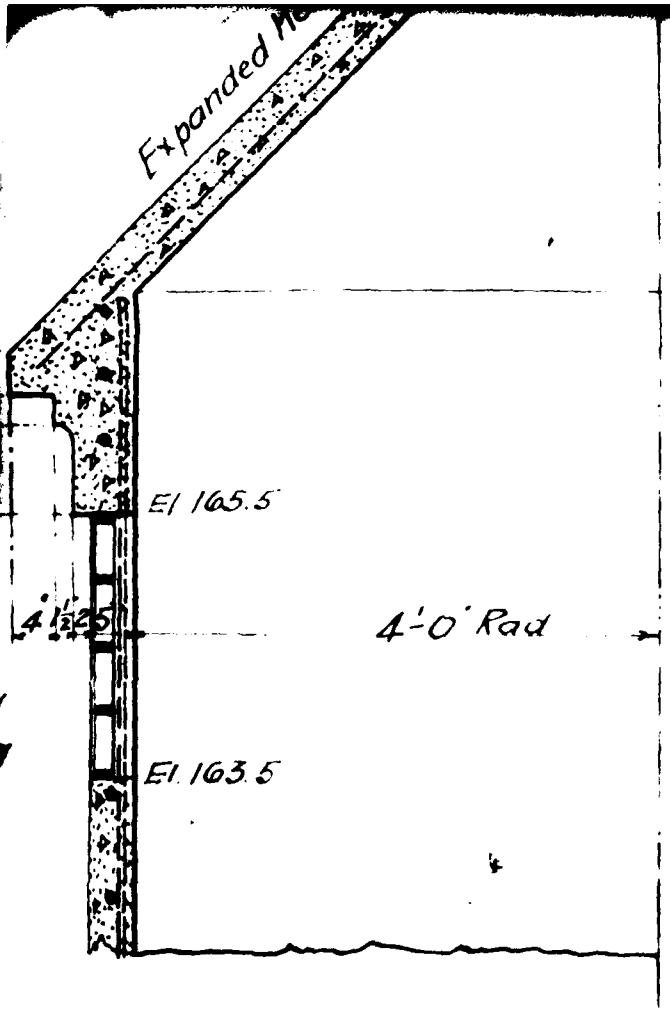


Detail of Window Grating.
5 Required.

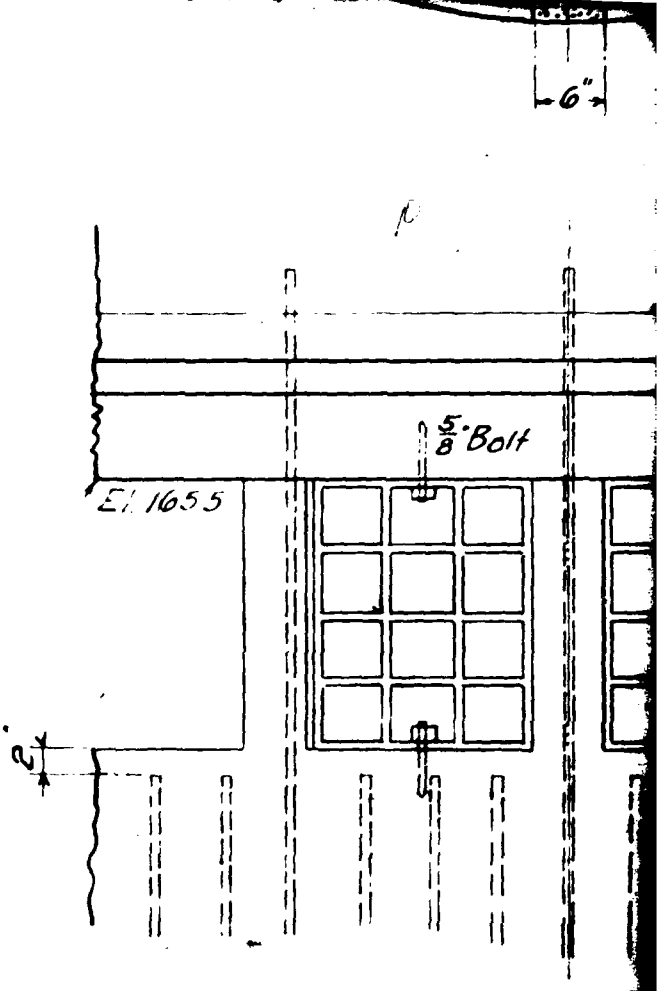


Detail of

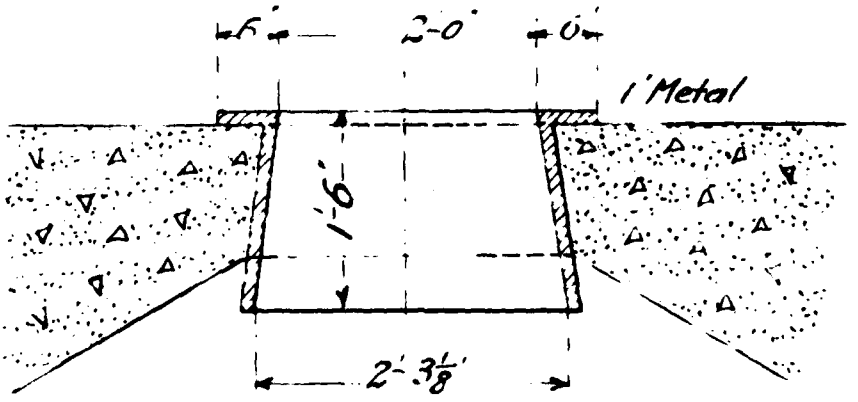
0



Detail of Tower Roof.



Detail of Top Window
12 Required.



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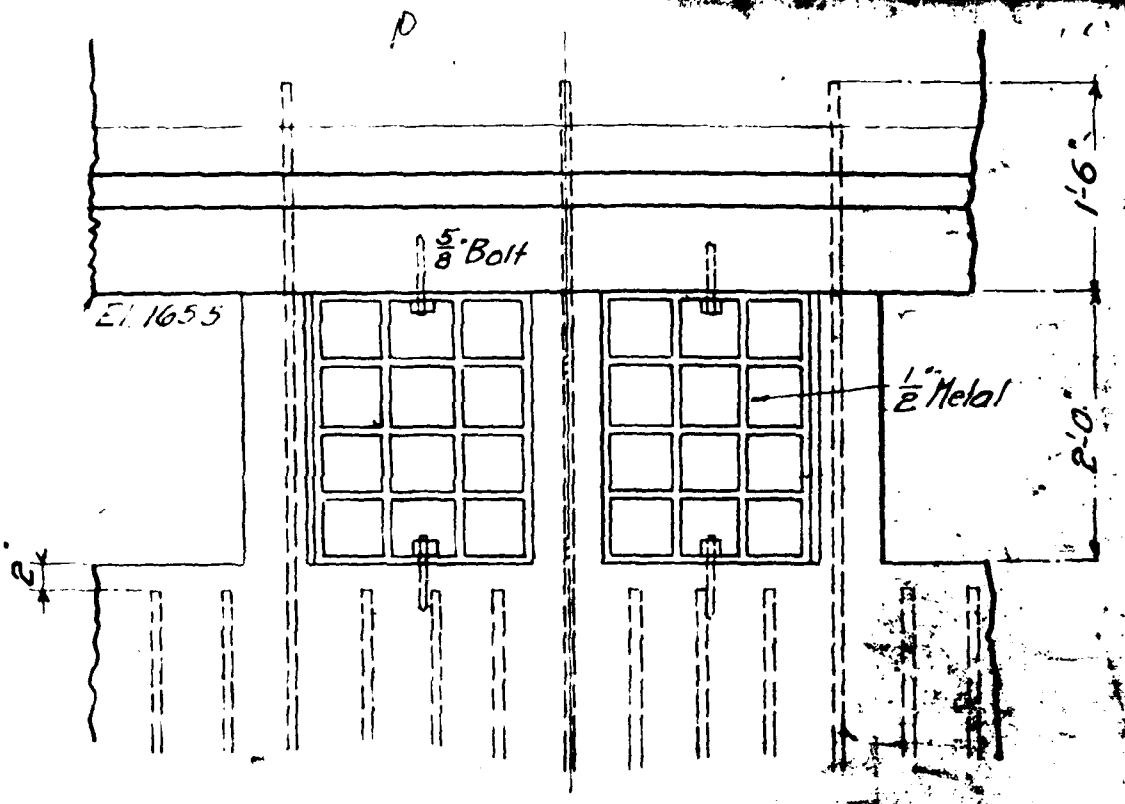
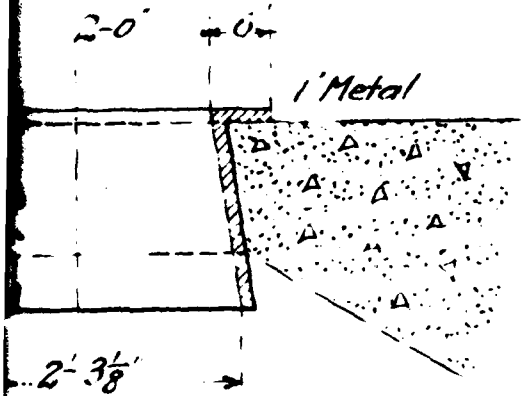
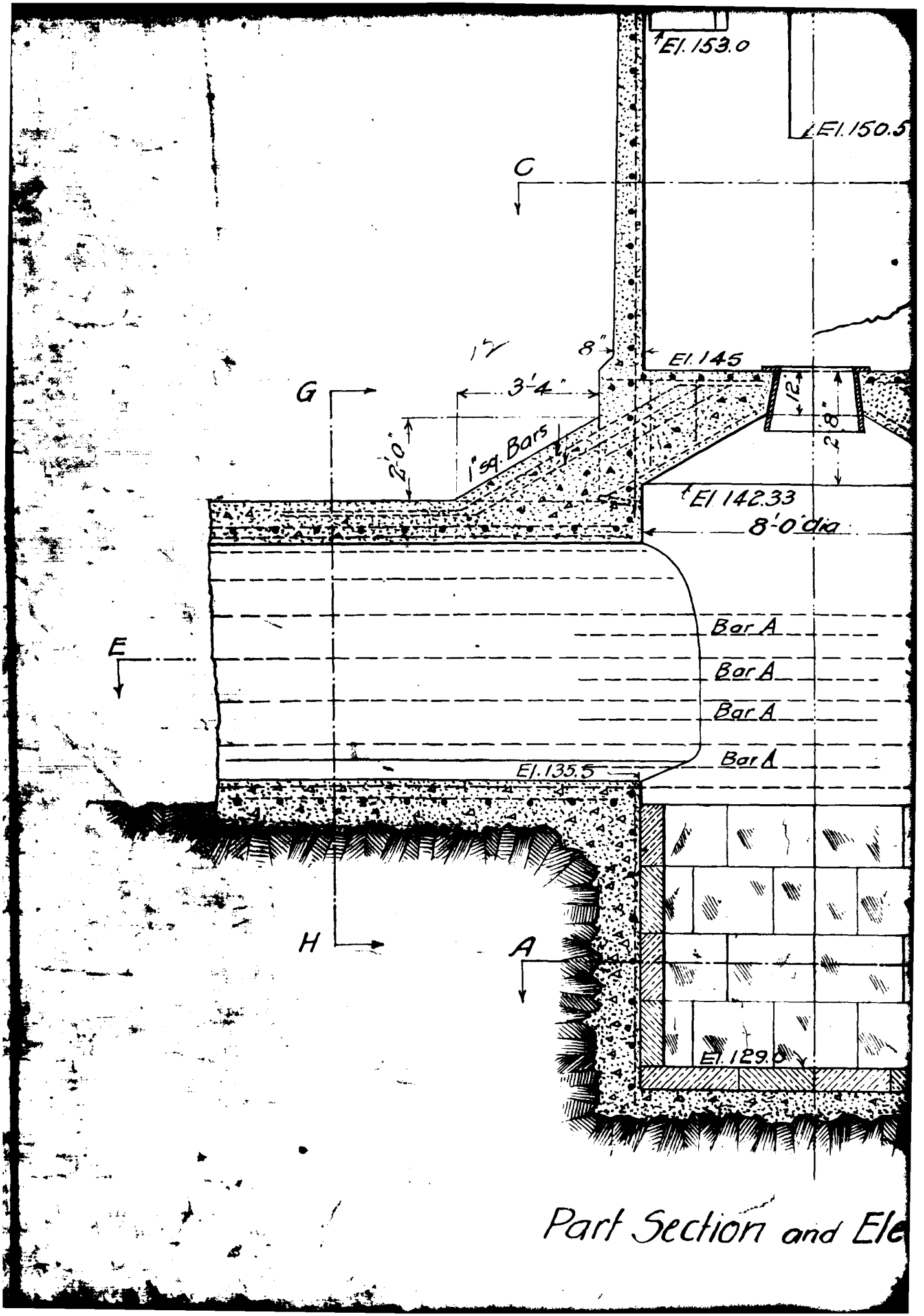


Detail of Top Windows & Grating.

12 Required.



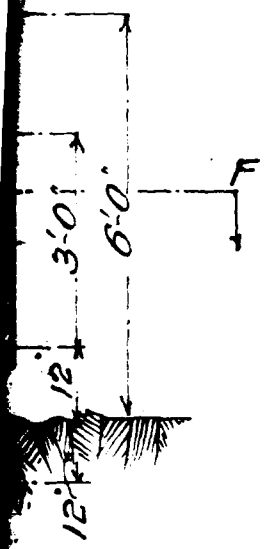


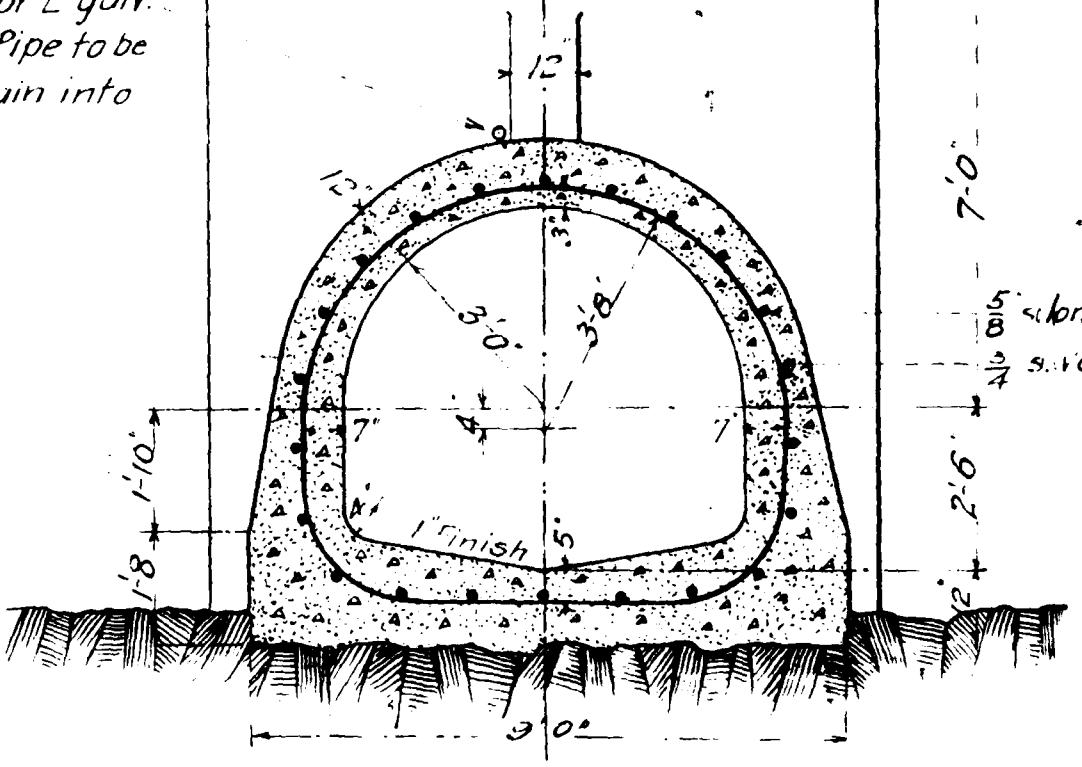
Part Section and Ele

13

Vent hole for 2" galv. iron pipe. Pipe to be laid to drain into Tower.

ed Metal
m, No 10 gauge.

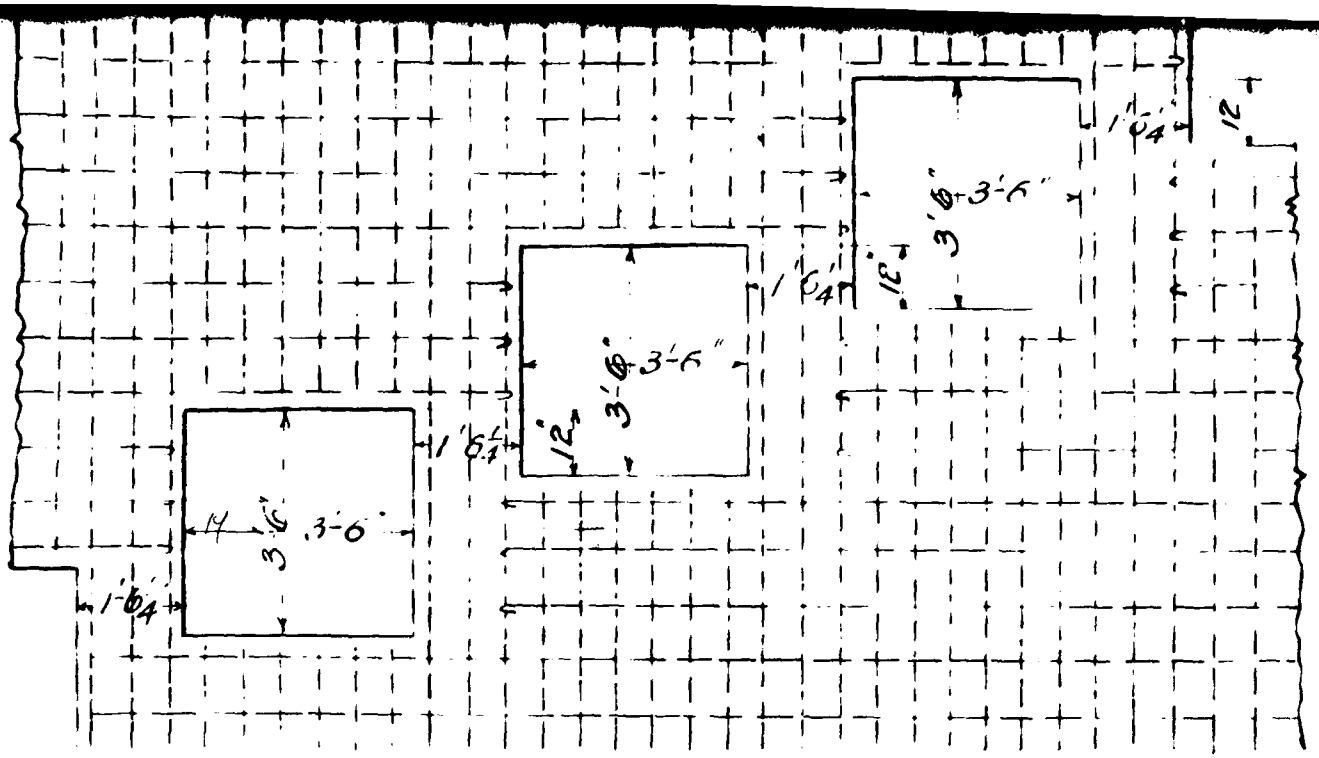




Section G-H.

0 1 2 3 4 5 6 7 8 9 10 Feet

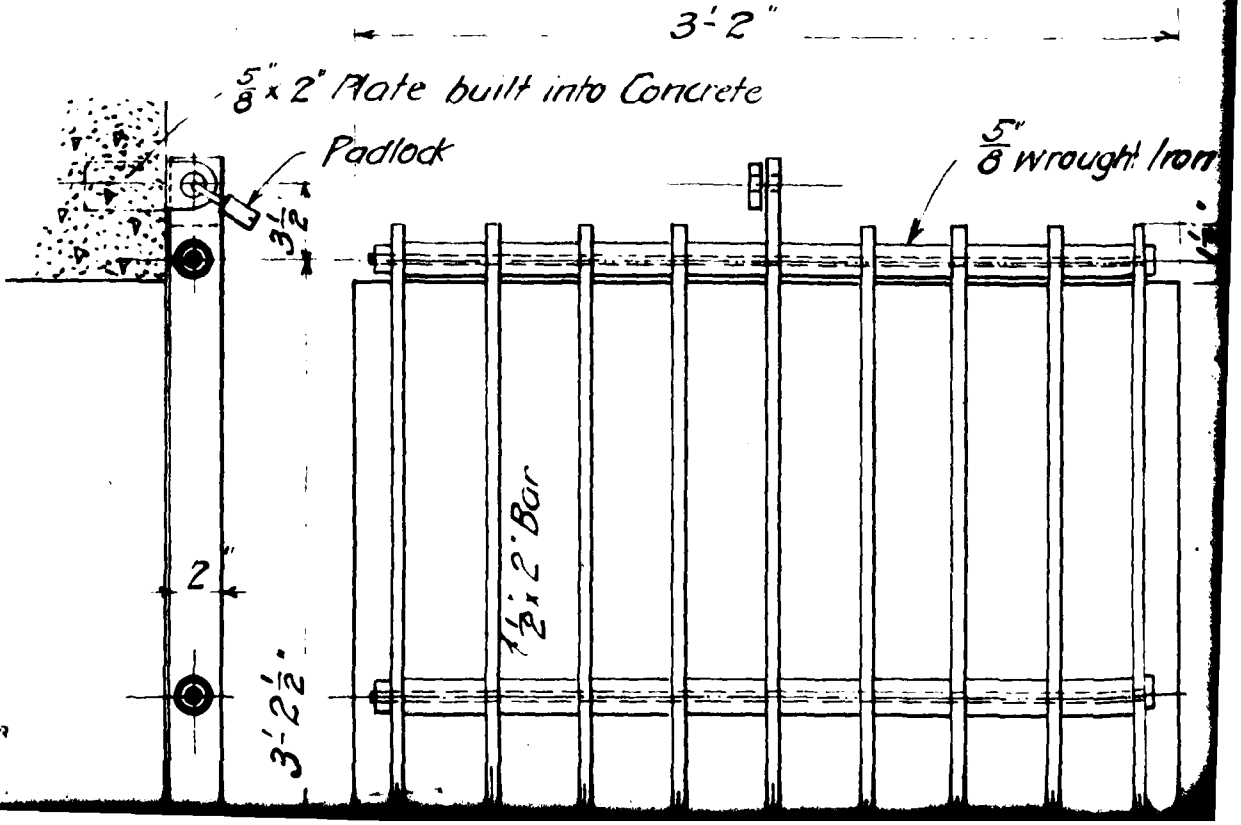
Scale

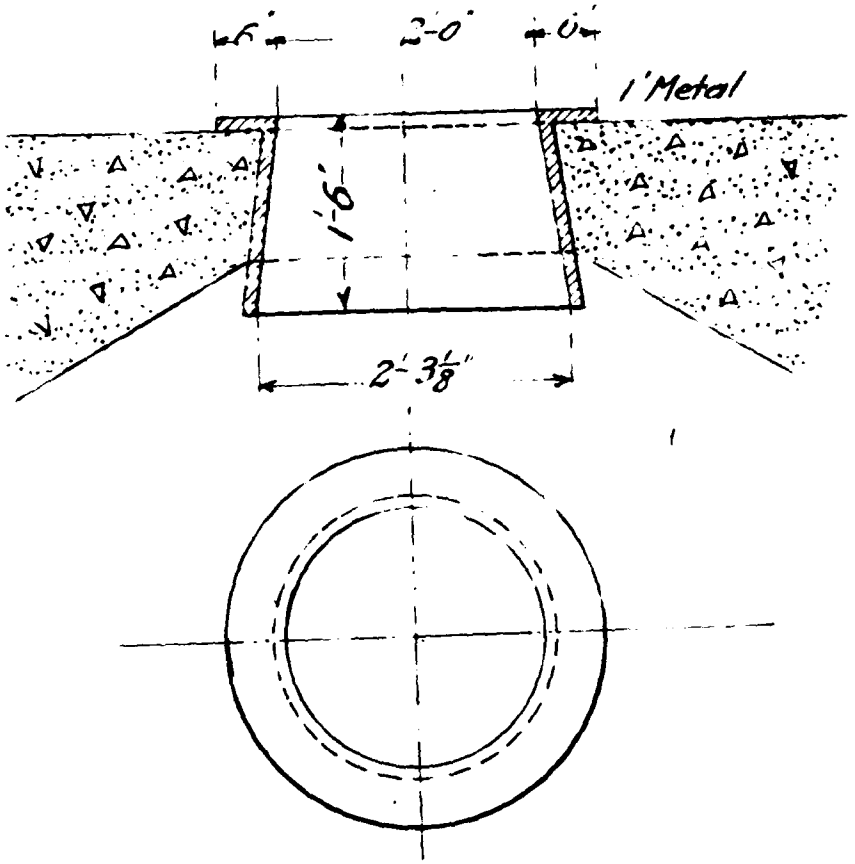


Development of Window Openings on inside diameter of Shell.

5/8" sq longitudinal Bars 12" c c

5/8" sq vertical Bars 12" c c

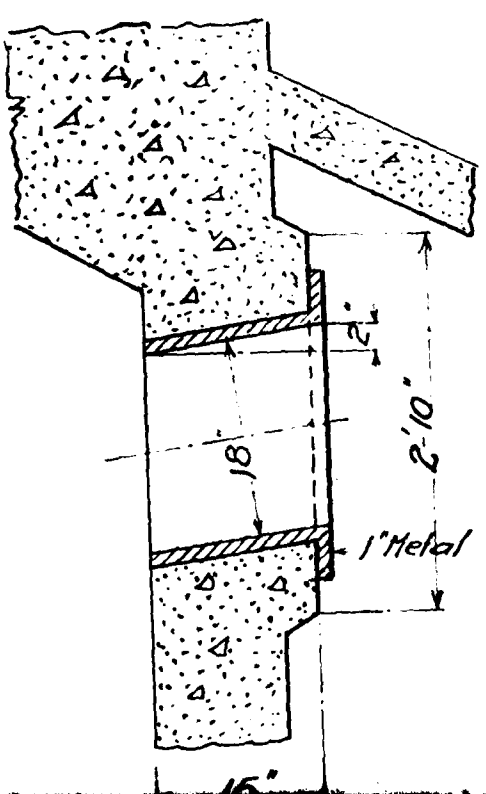


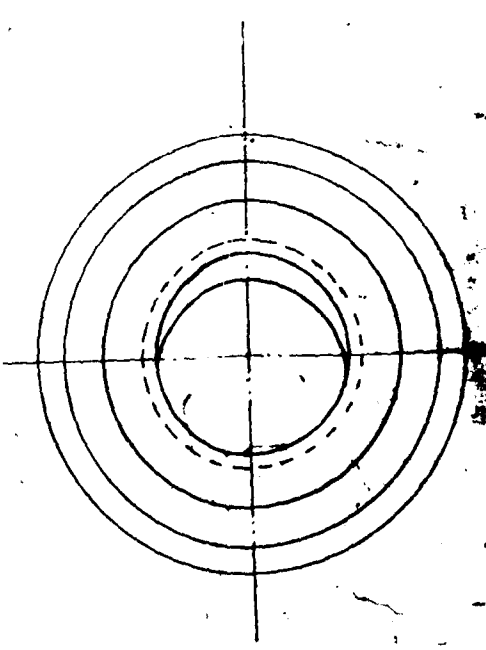


15

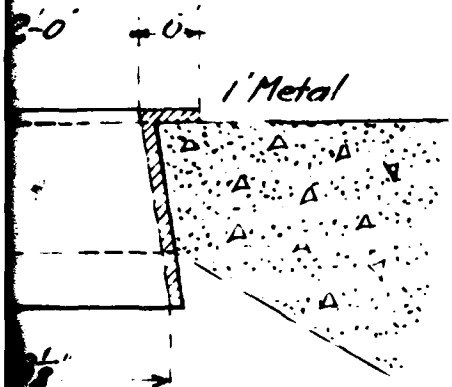
Detail of Orifice in Floor.

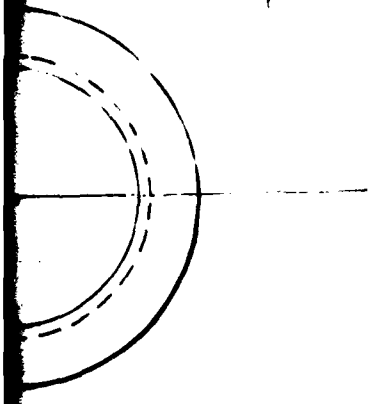
Separators



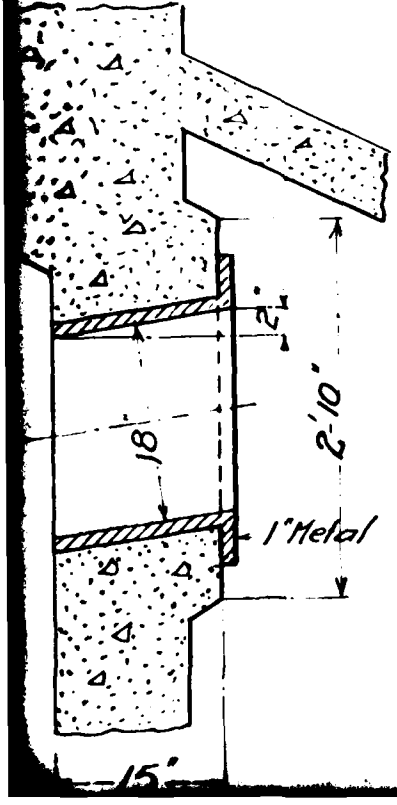


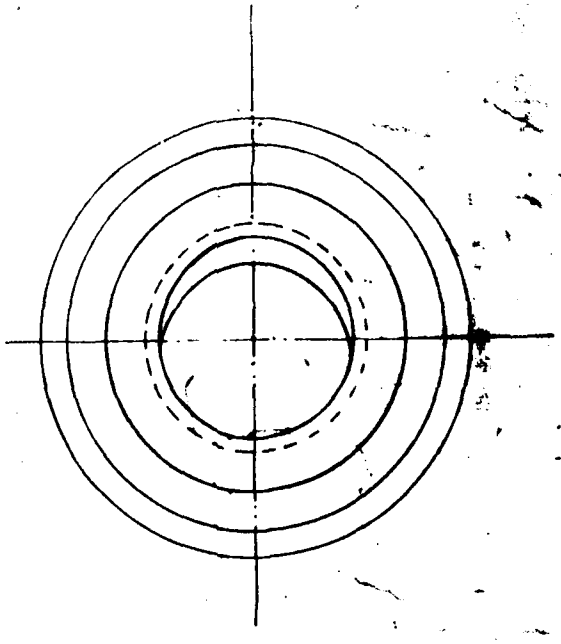
3-0



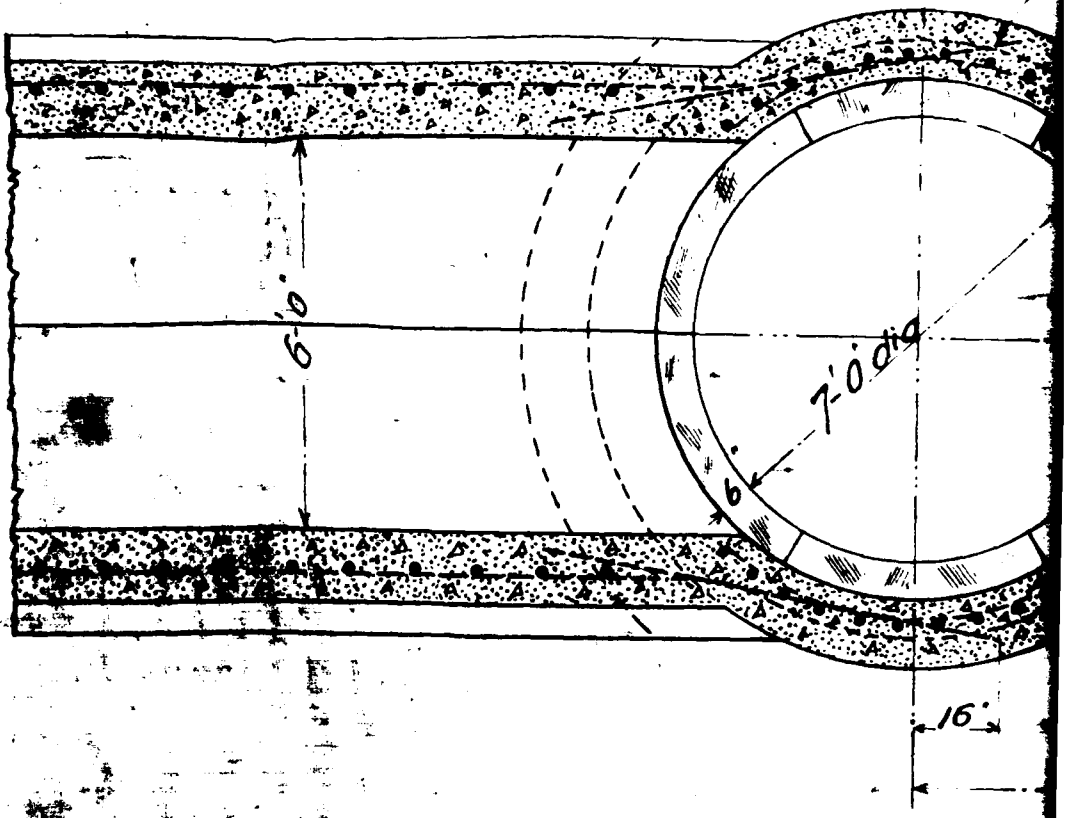


e in Floor.





Part Section and El

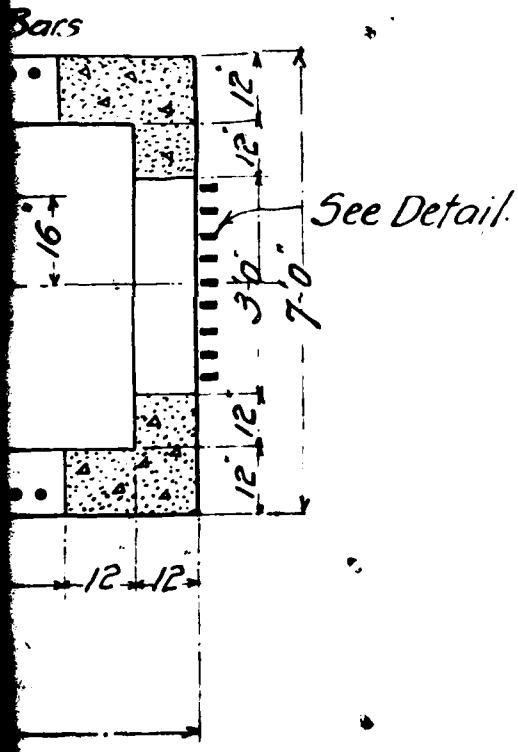


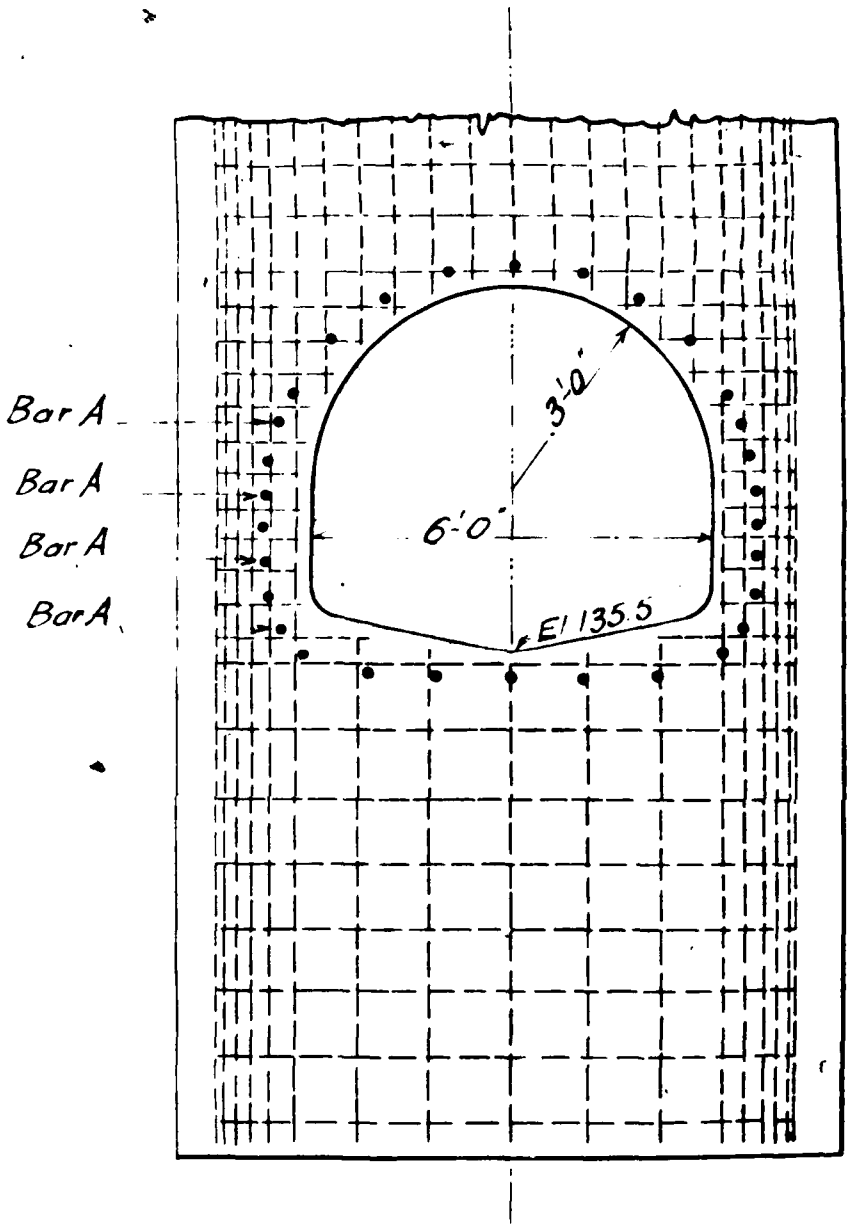
Section E-F

...Bars to be High elastic limit corrugated Steel
...placed not less than 2 inches from Face

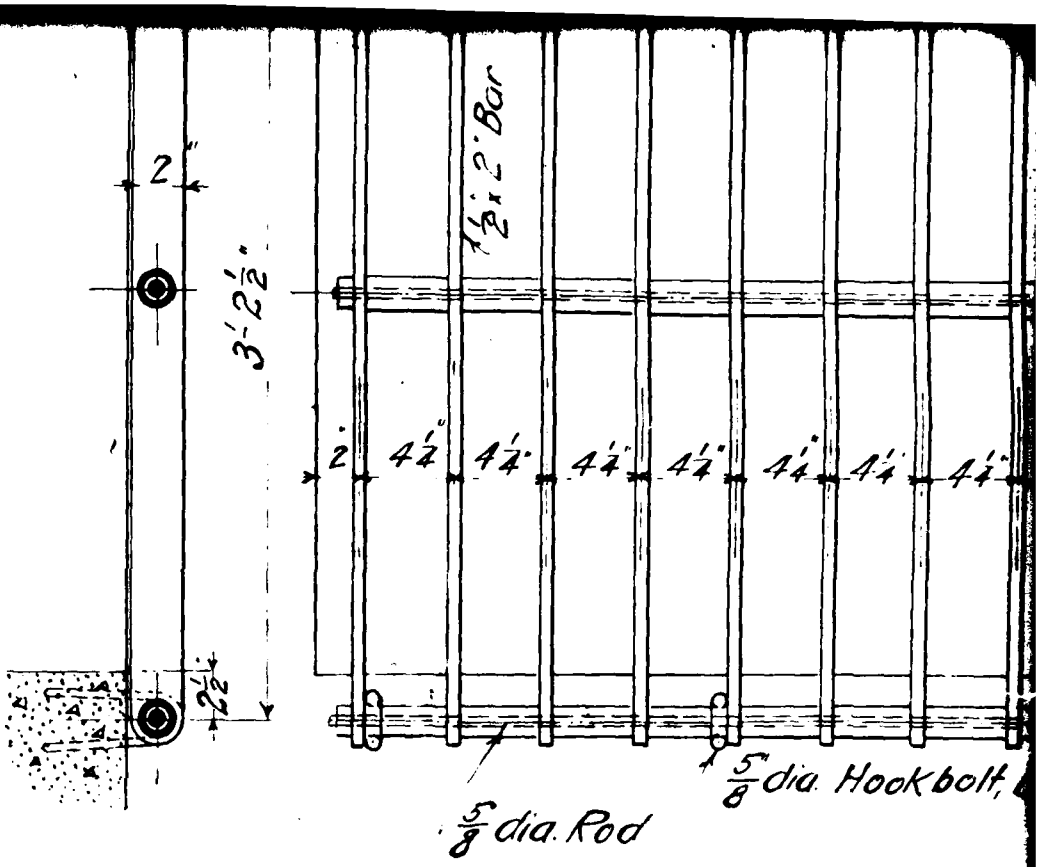
Scale

17





Elevation showing Connection of G
Bars into Tower.



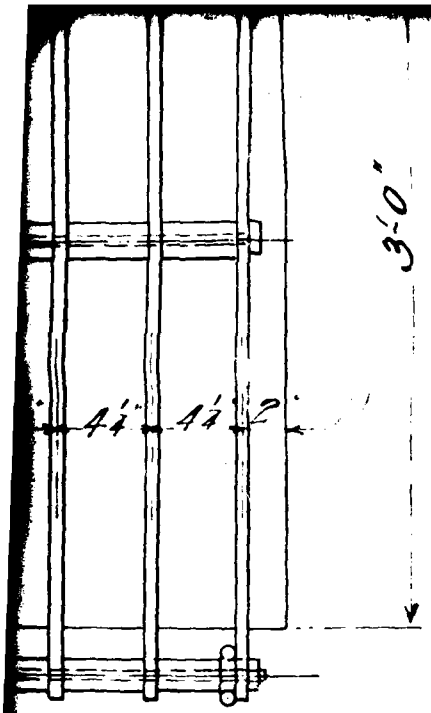
Detail of Grating for Intake B

To be used also on Intake Box of Lower Towe

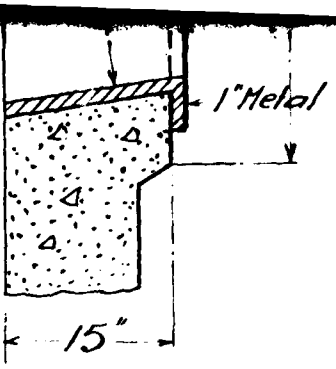
of Conduit

WATER

Item 10.



ookbolt, built into Concrete



Detail of Normal Flow Inle

ake Box.

wer Tower.

INTAKE AND CONDU

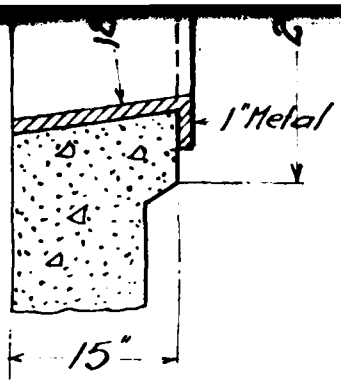
UPPER DAM.

ERVLIET STORM SEWER C

SCALE 3/8 & 3/4 "=1FOOT. NOV.1911.

SOLOMON, NORCROSS & KEIS.

ENGINEERS.



Detail of Normal Flow Inlet Pipe.

17

AND CONDUIT.

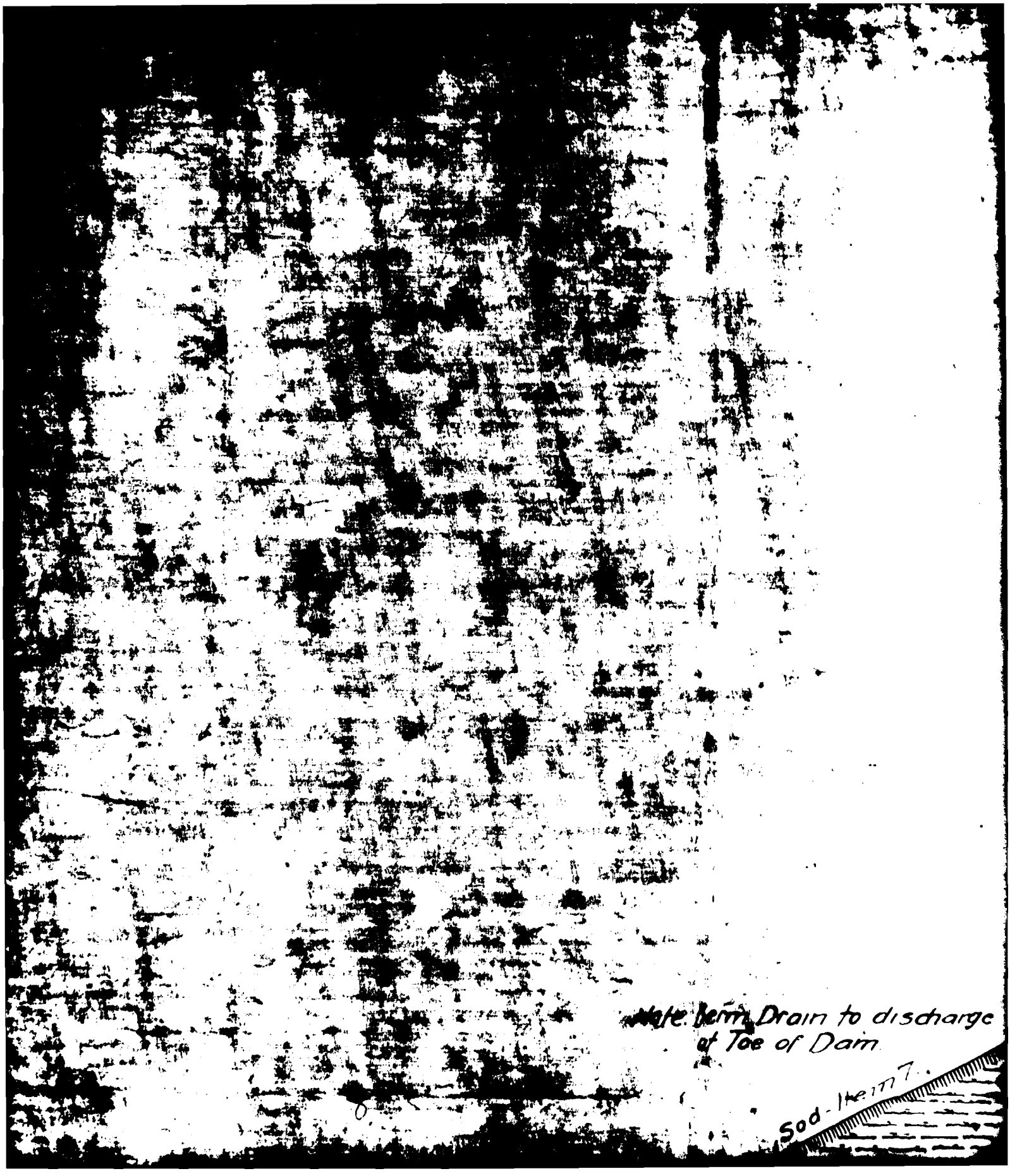
ER DAM.

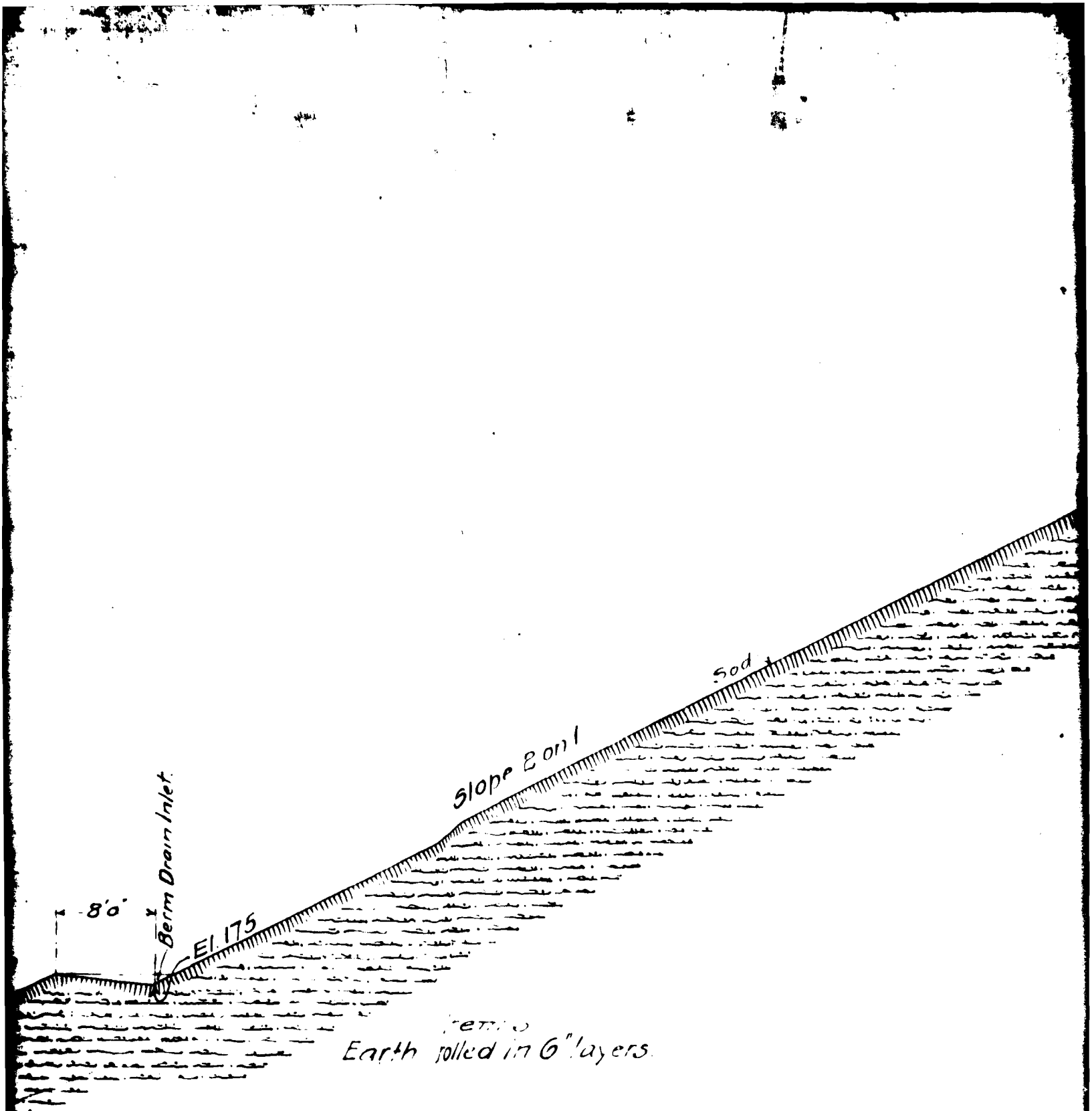
M SEWER COMMISSION.

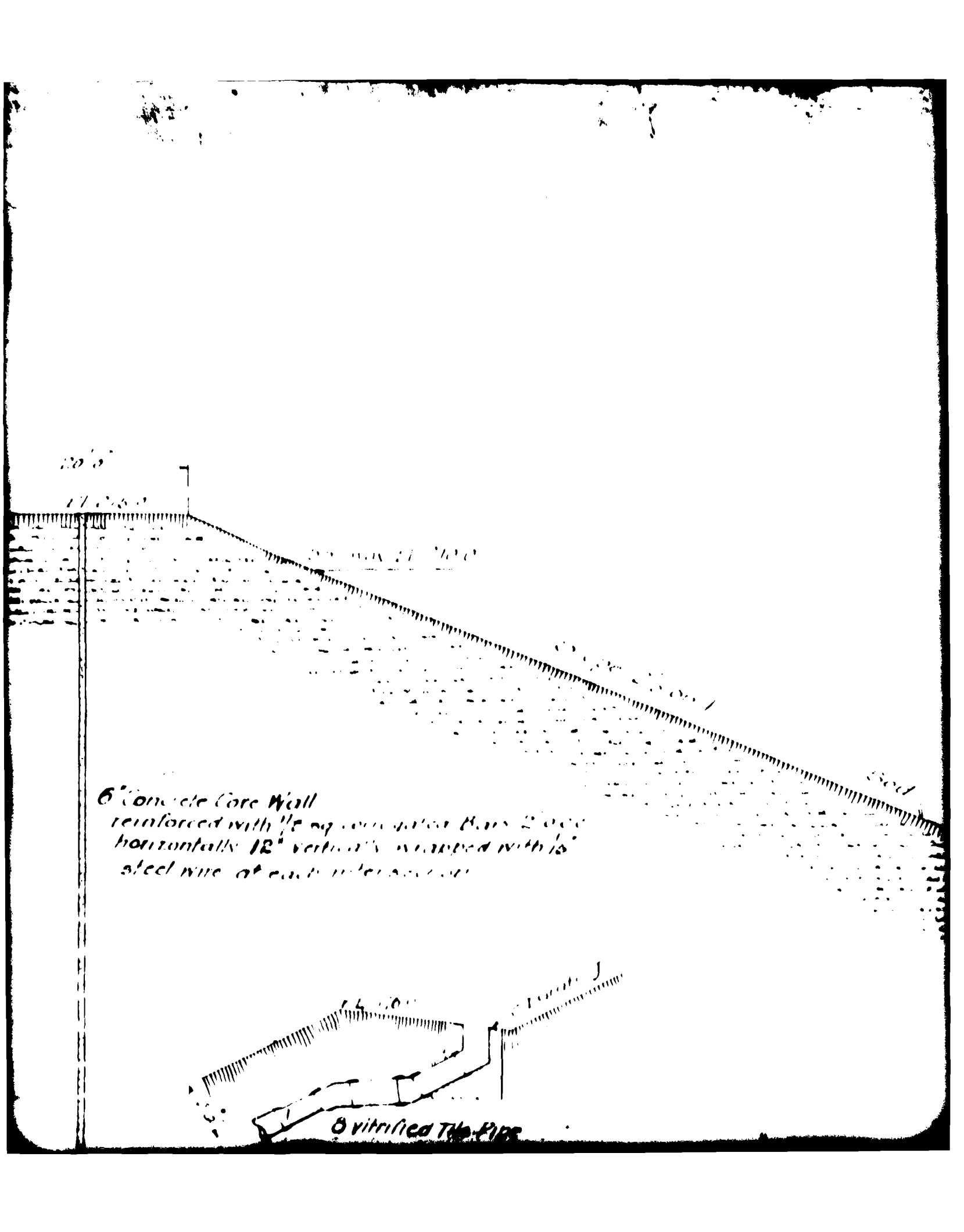
"=1FOOT. NOV.1911.

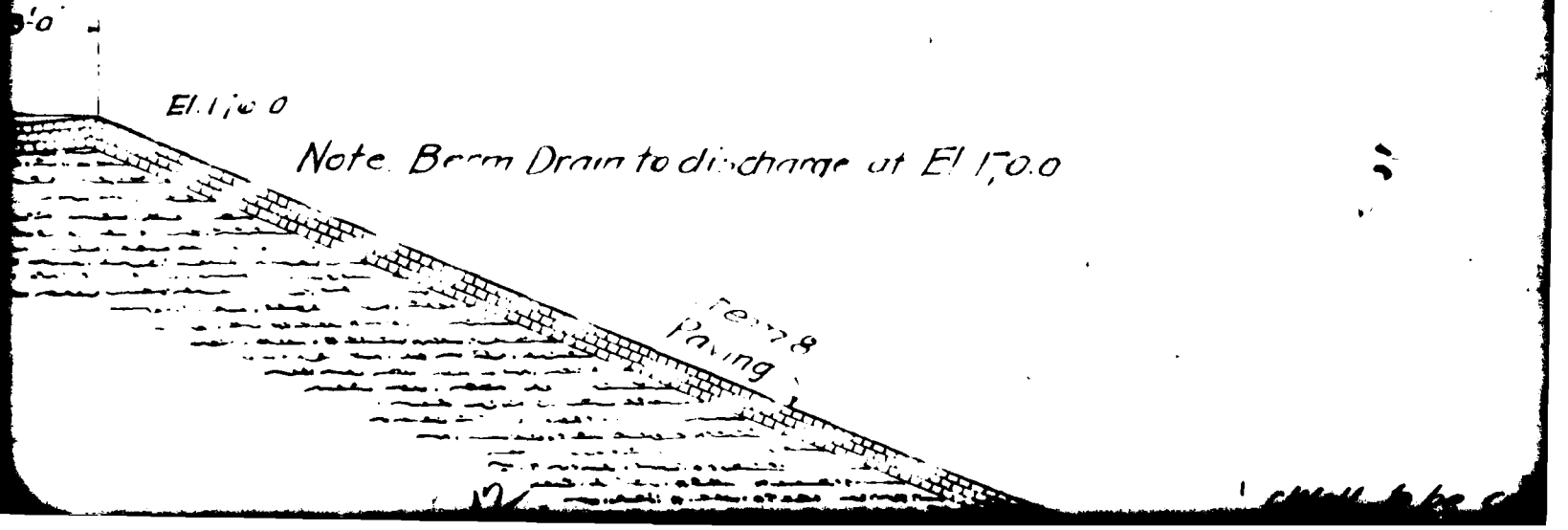
RCROSS & KEIS.

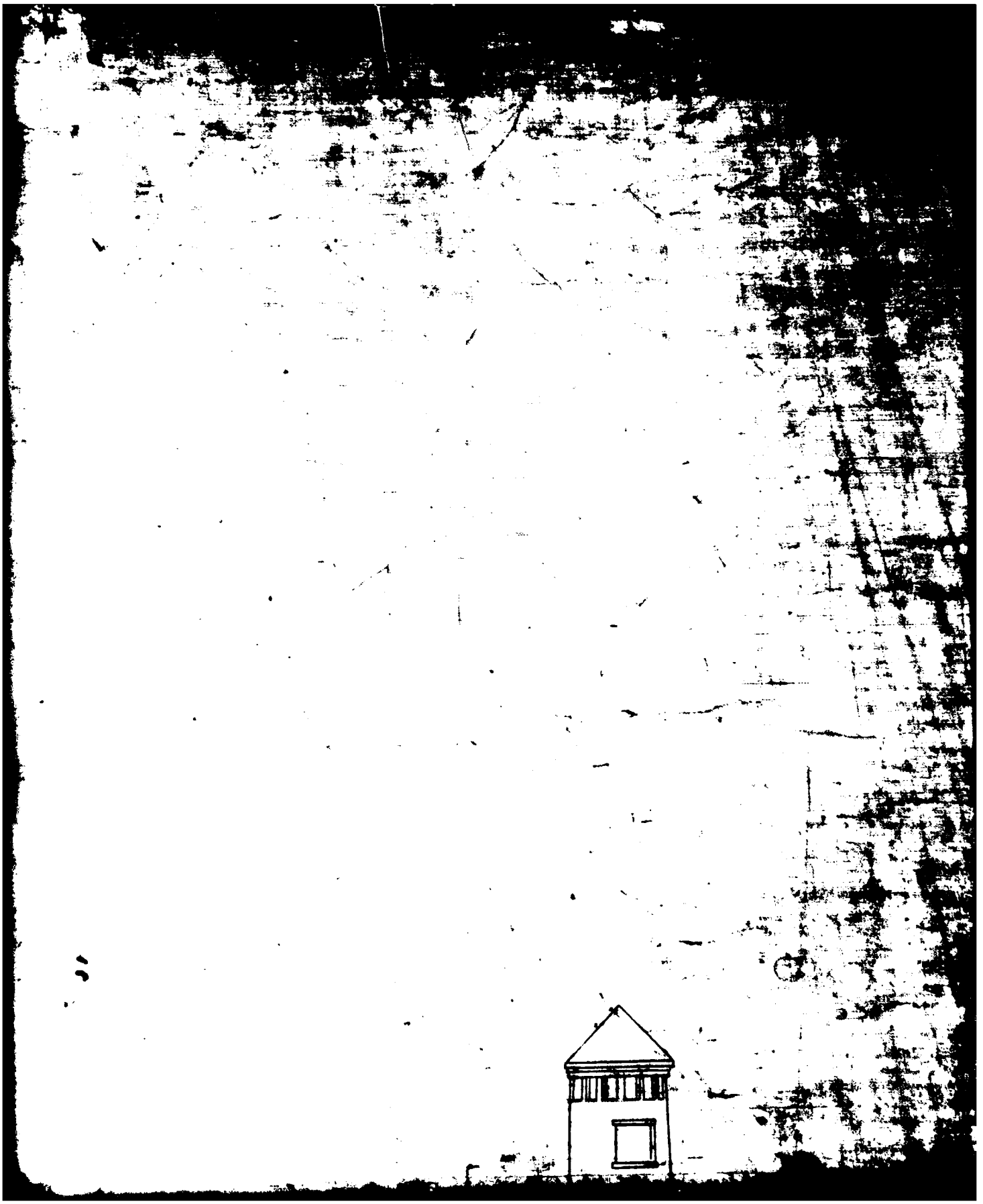
INEERS.

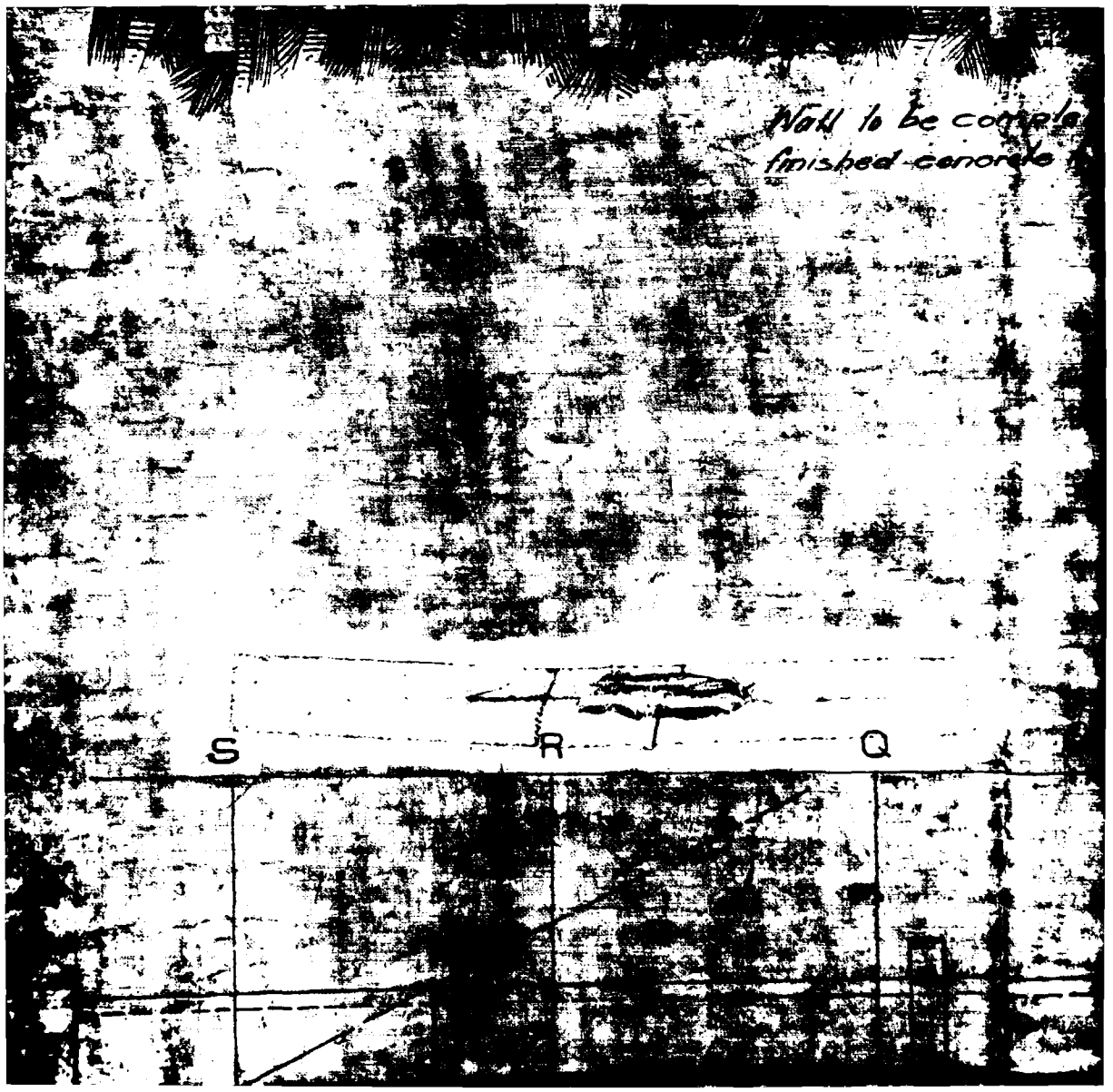

Note: Berm Drain to discharge at Toe of Dam
Sod - Item 7.


8'0"
Berm Drain Inlet
El. 175
Slope 2 on 1
sod
Earth rolled in 6" layers

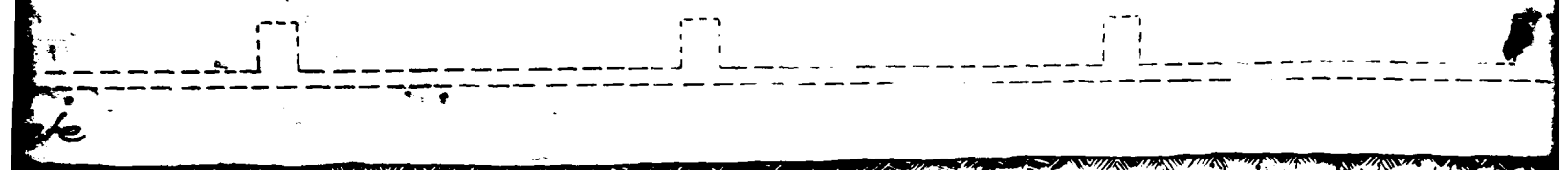

6" Concrete Core Wall
reinforced with
horizontally
steel wire
8 Vitrified Tile Pipe


El. 1,00 0
Note. Berm Drain to discharge at El 1,00.0
Paving



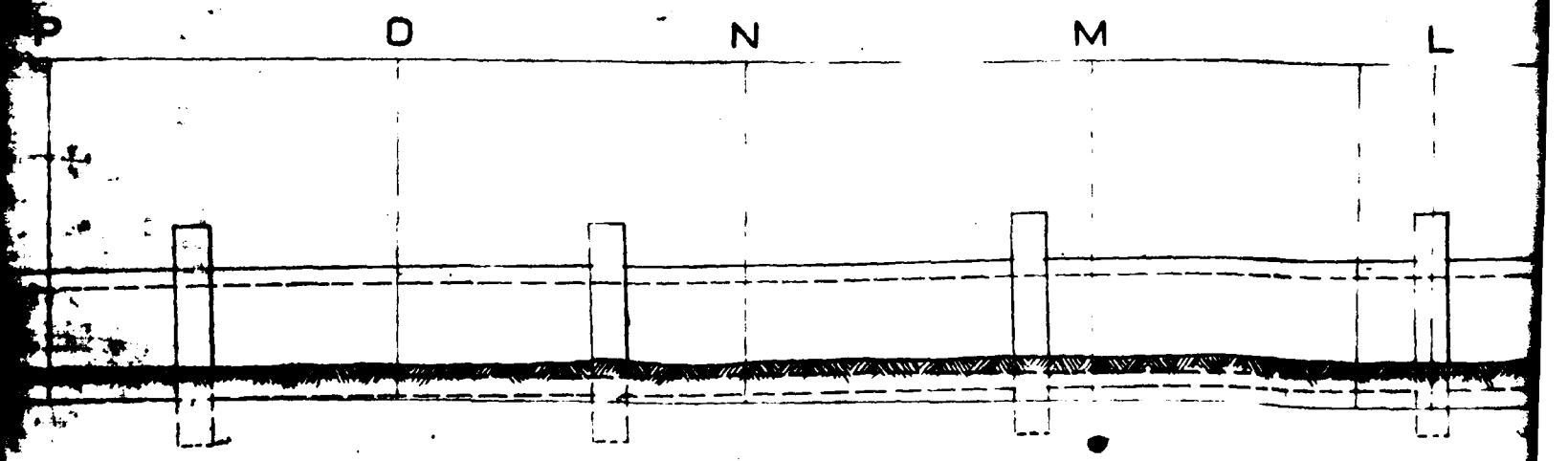

Wall to be comple
finished concrete
S
R
Q

d - the 77.



le

k from
e of dam



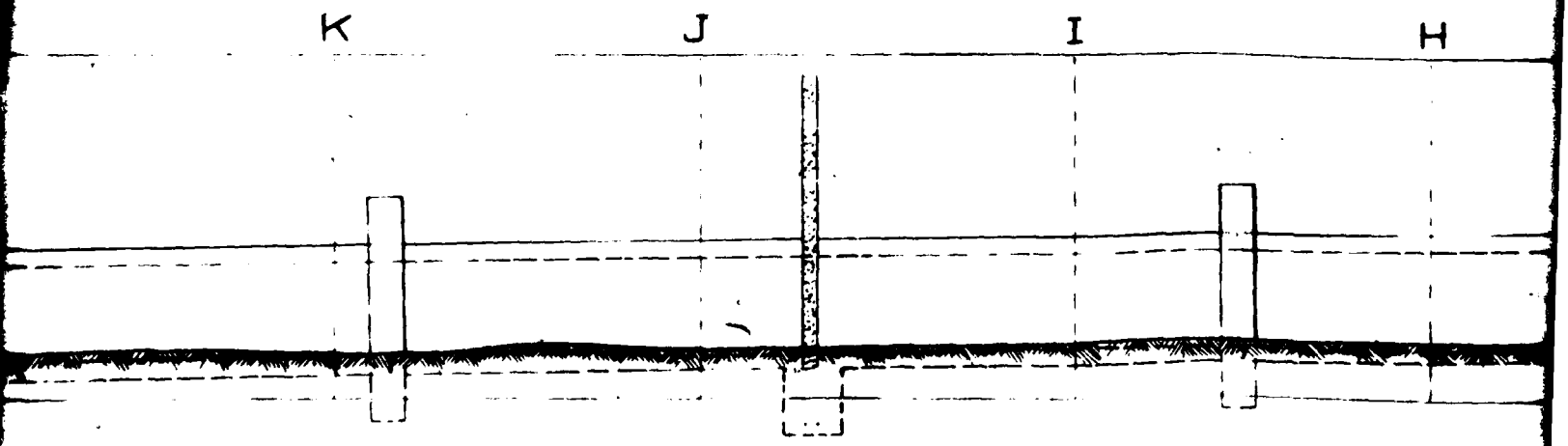
10

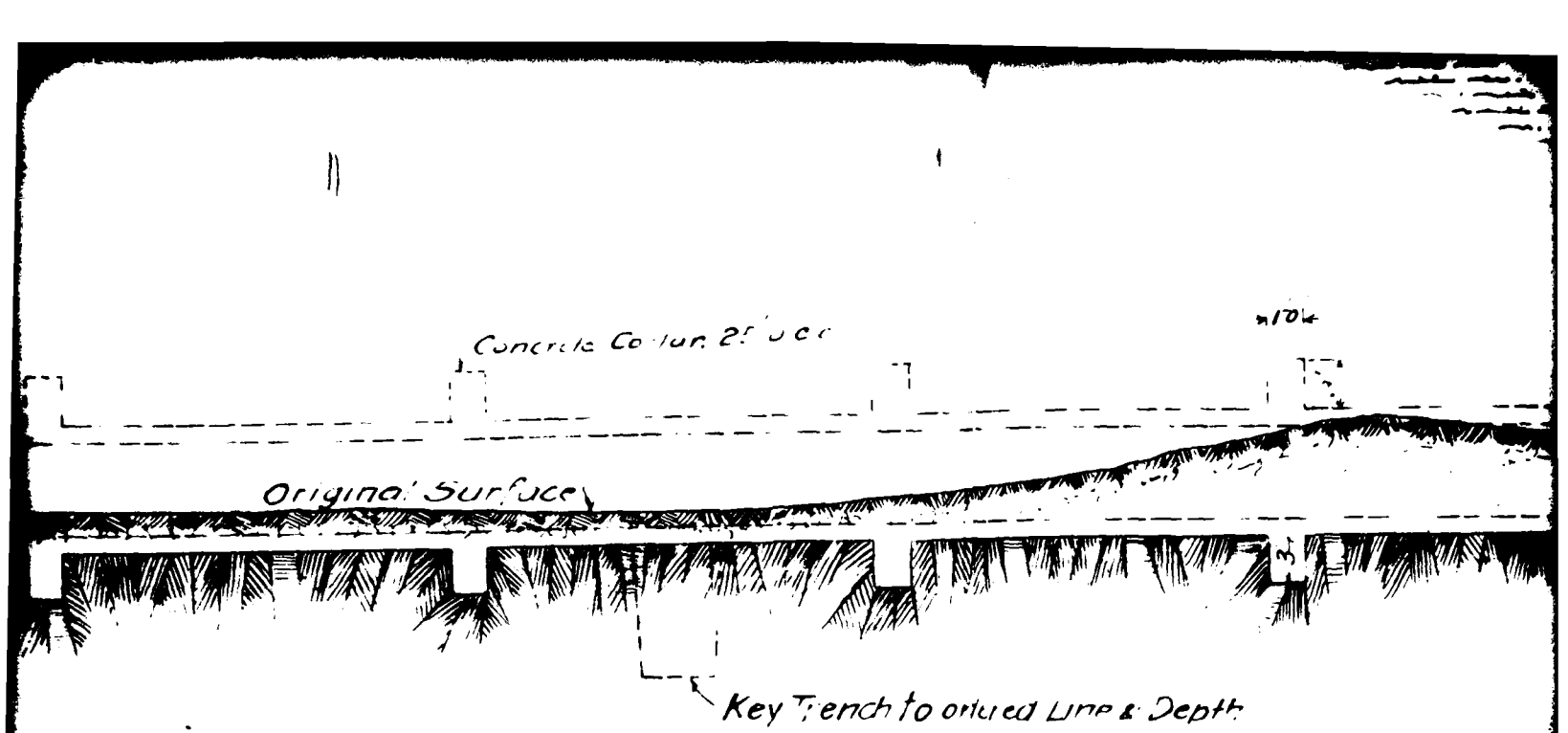
8 Vitrified Tile

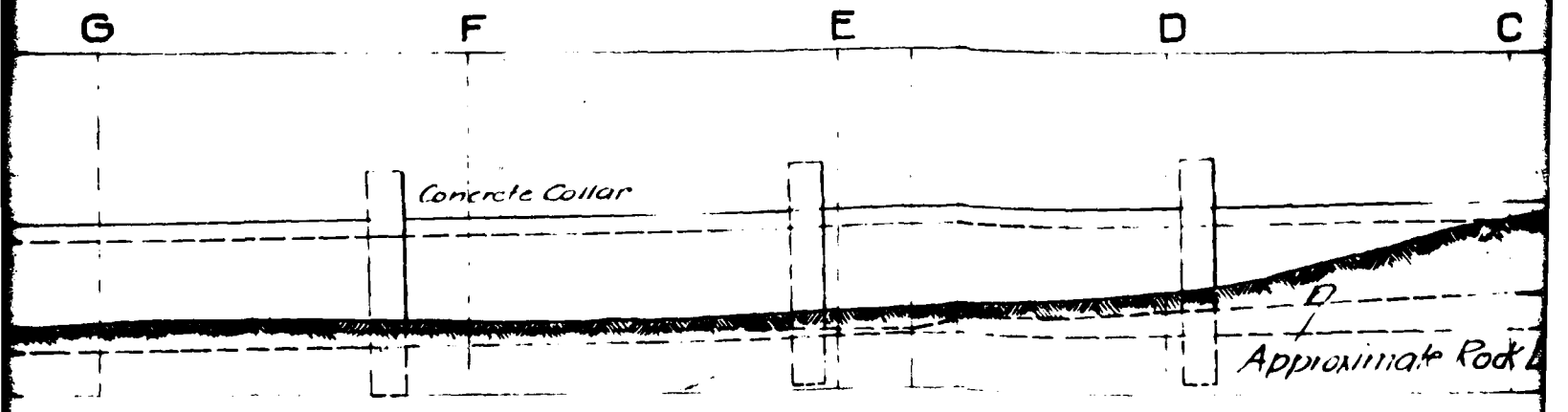
Drain Inlet

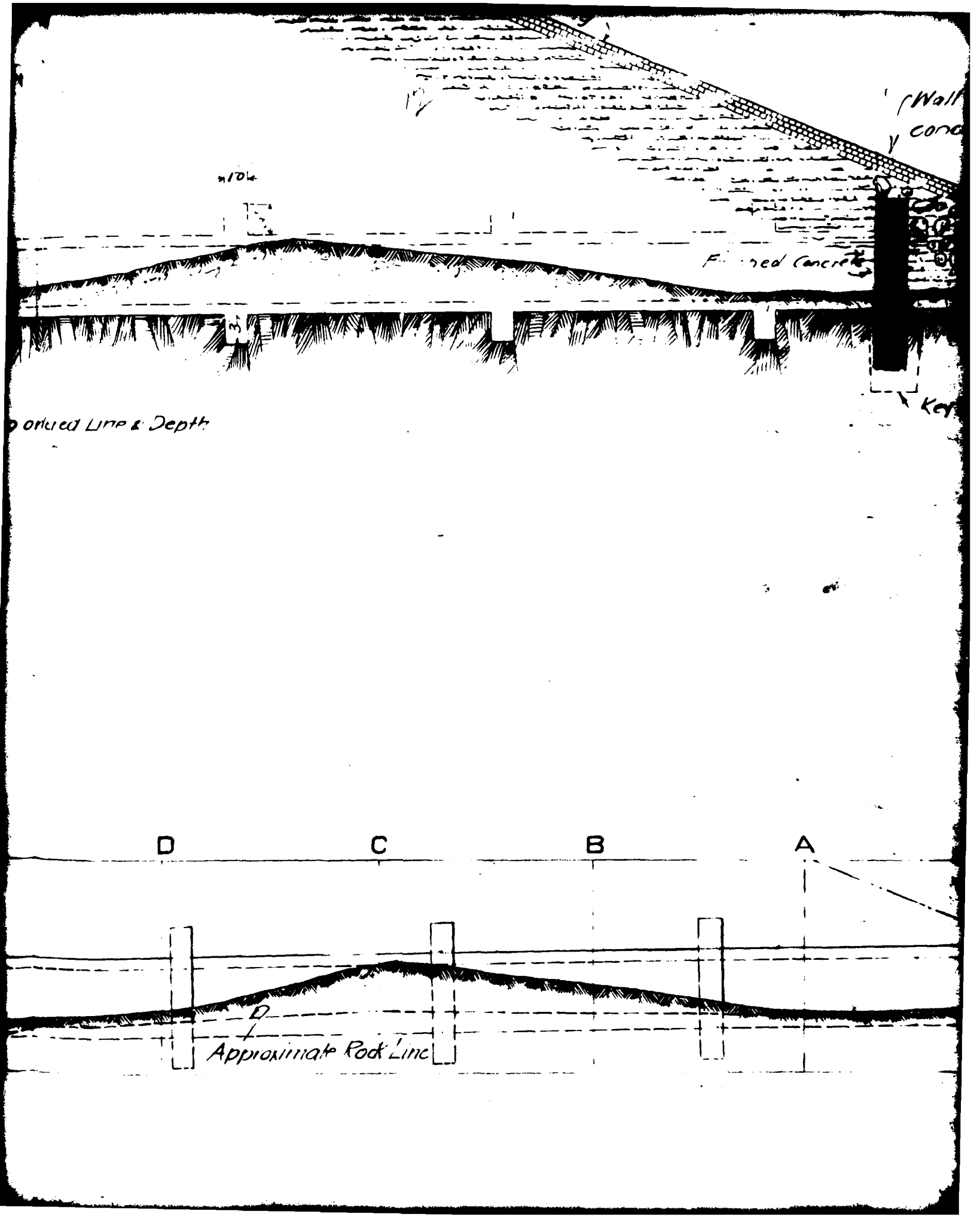
3' Key to ordered Depth.

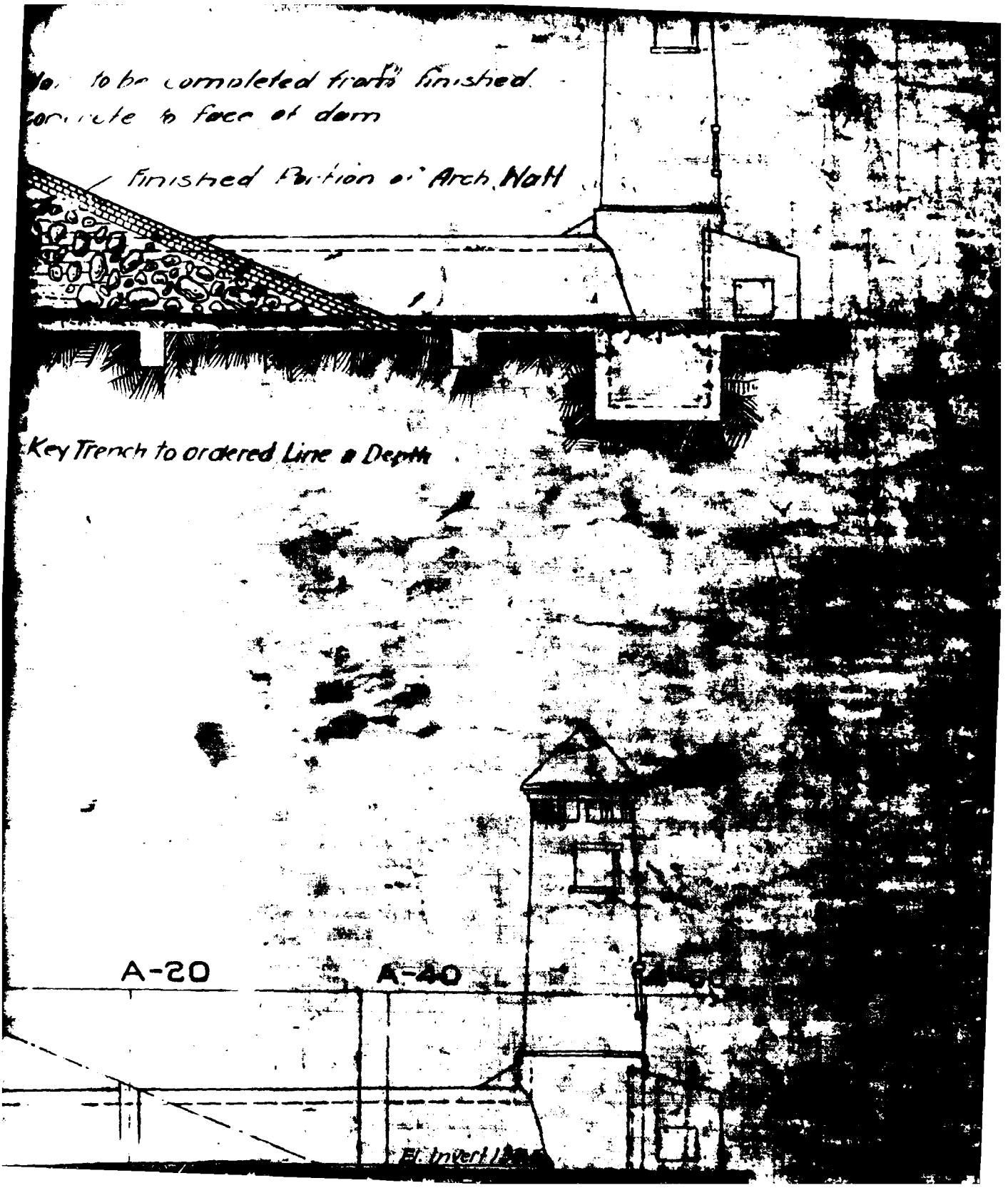
TYPICAL SECTION OF DAM.

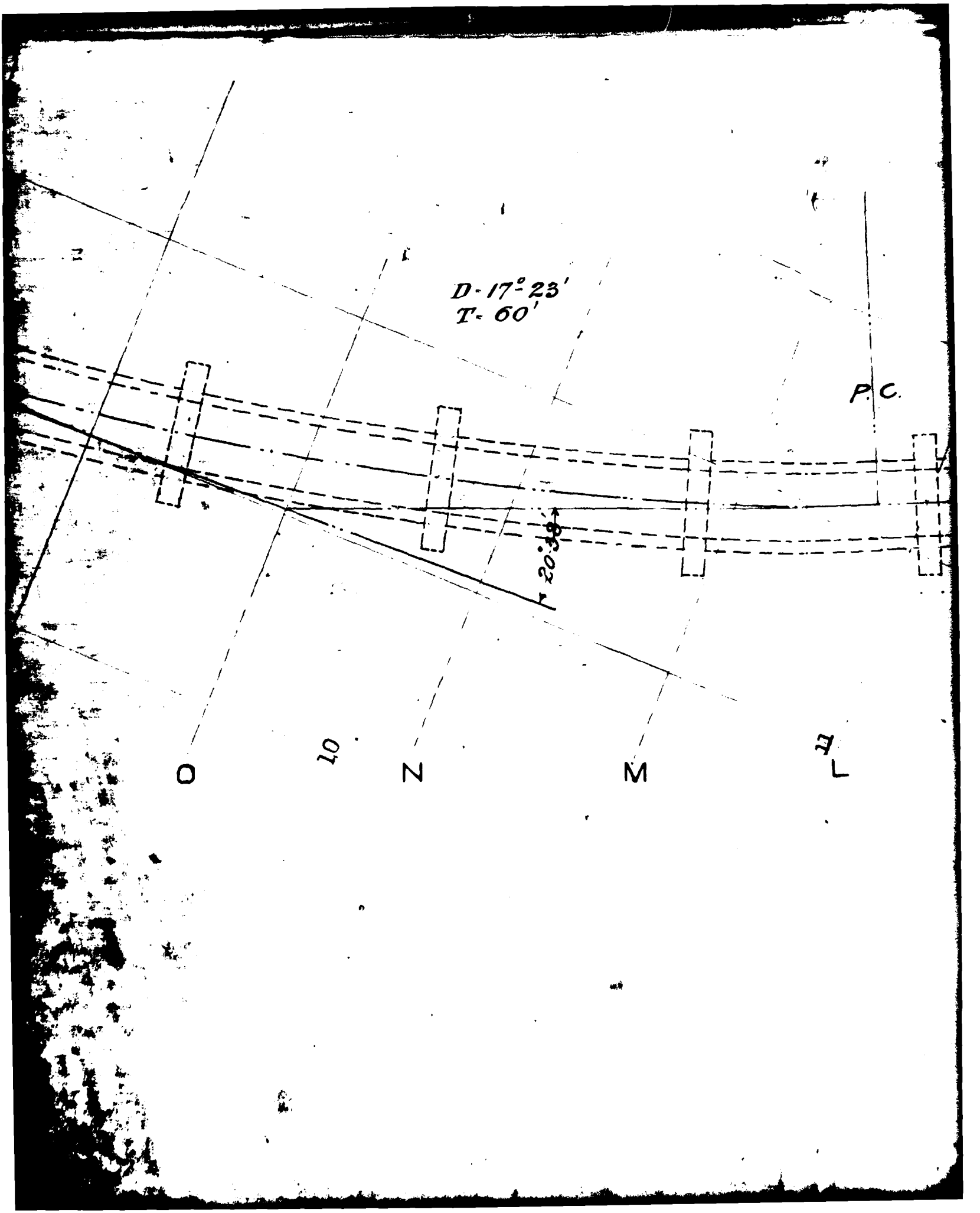



Concrete Collar 2' x 2'
Original Surface
3'
Key Trench to ordered Line & Depth

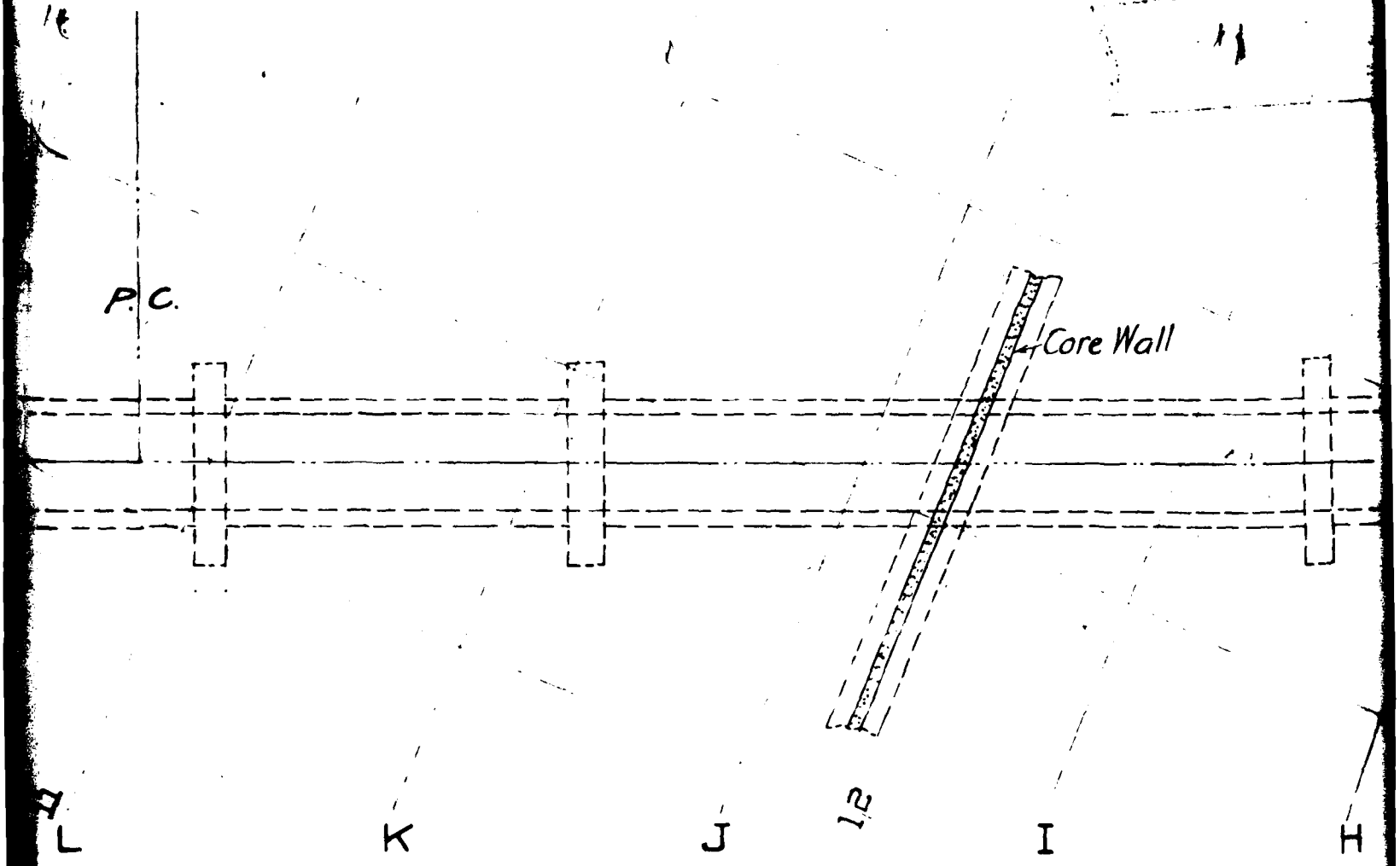

G
F
E
D
C
Concrete Collar
D
Approximate Rock


Wall
cond
Finished Concrete
Key
Drilled Line & Depth
D
C
B
A
D
Approximate Rock Line


to be completed from finished
concrete to face of dam
finished Portion of Arch Wall
Key Trench to ordered Line & Depth
A-20
A-40


D-17°23'
T-60'
P.C.
20.38
O
10
N
M
11
L

DEVELOPMENT OF PROFILE ALONG

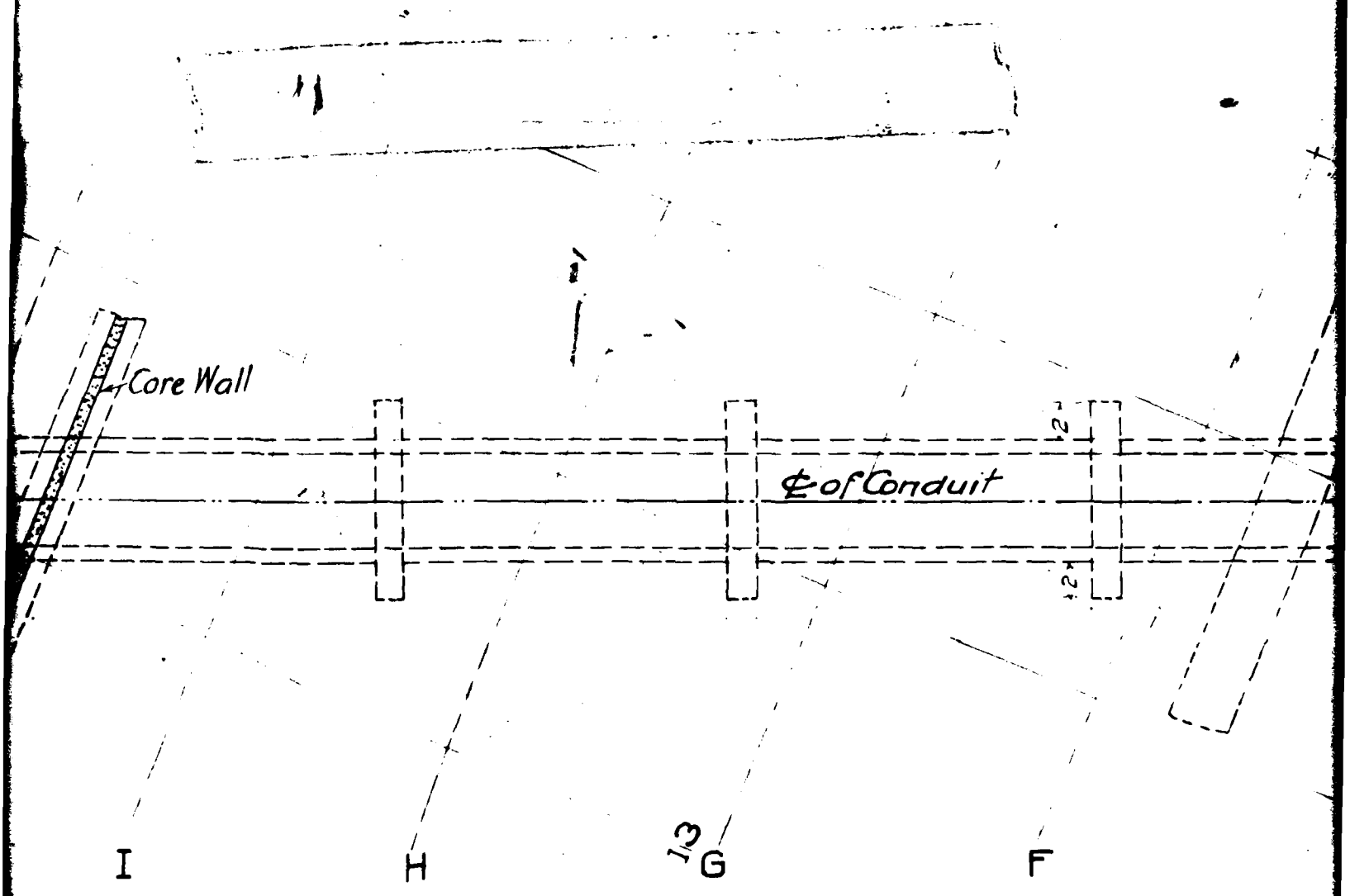


ALIGNMENT OF CONDUI

0 5 10 20 30 40 50

scale

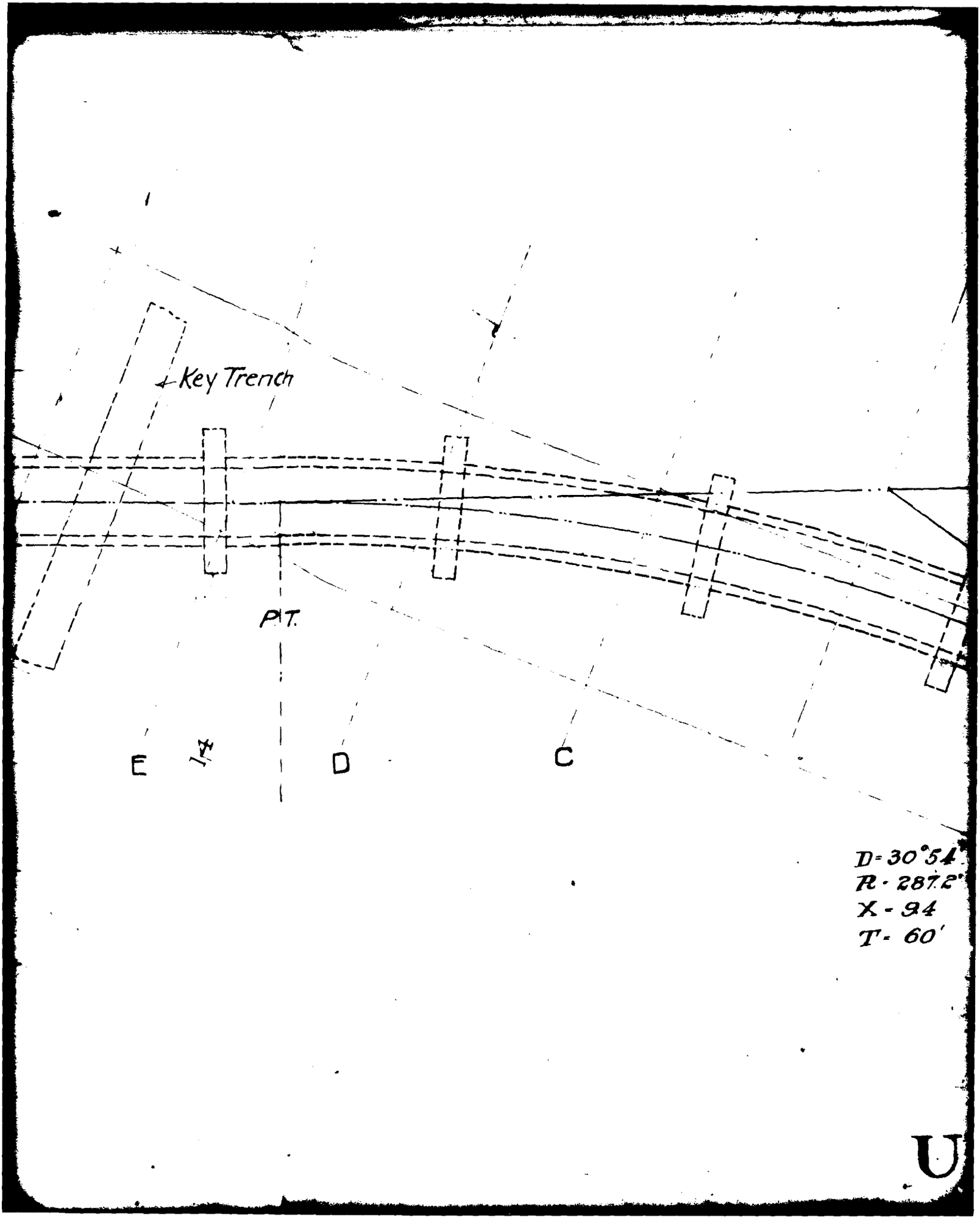
ROFILE ALONG ℄ OF CONDUIT.

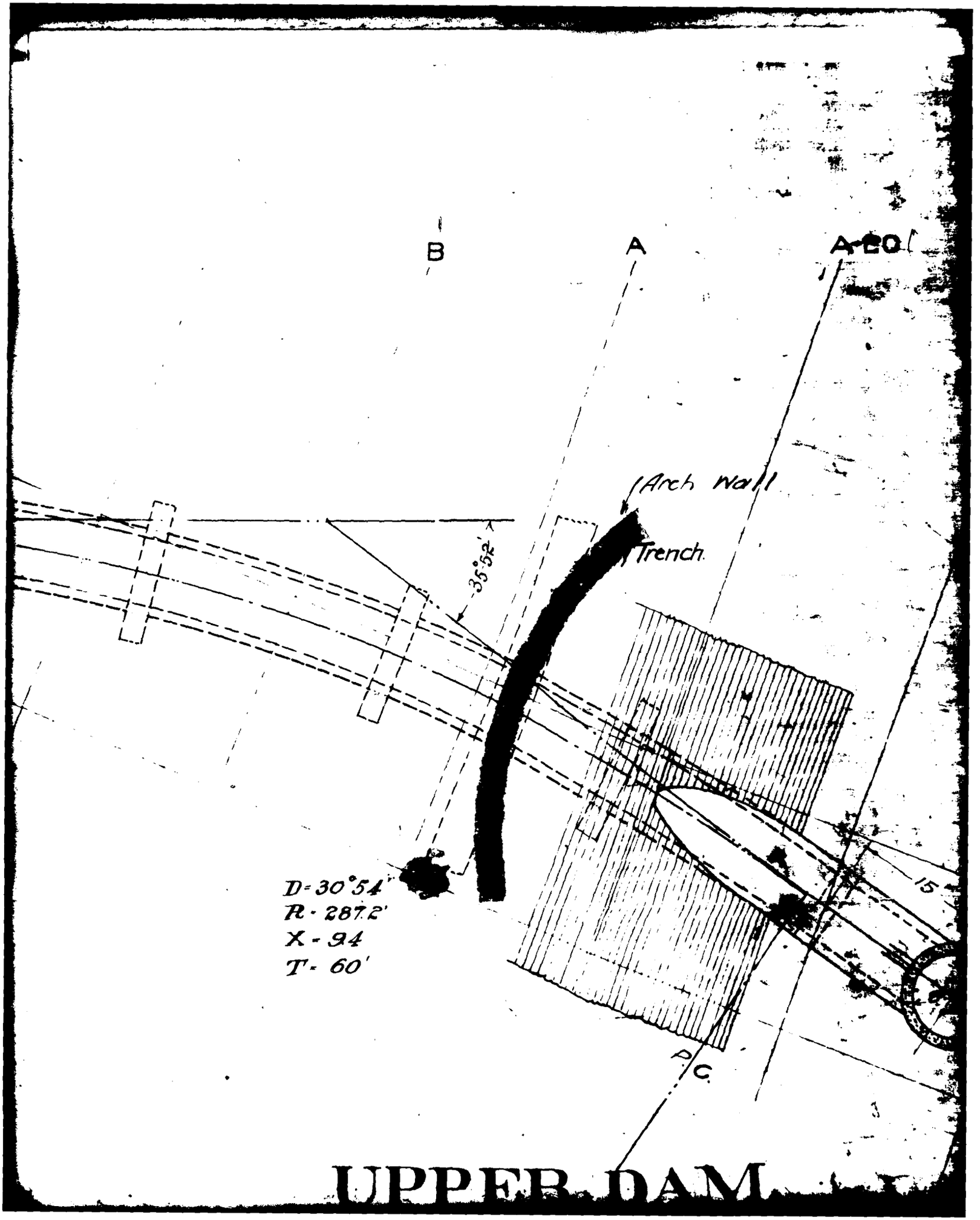


NT OF CONDUIT.

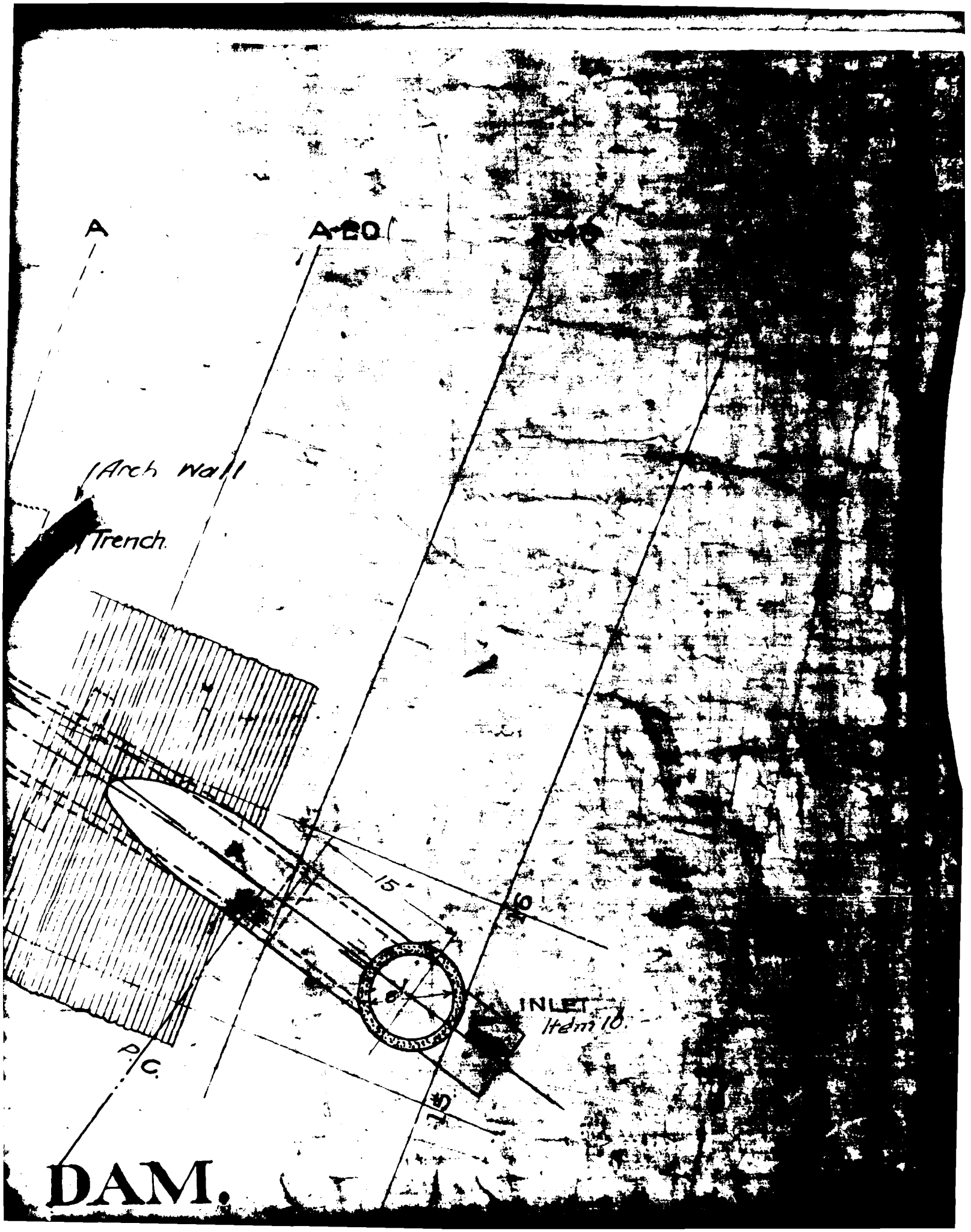
30 40 50 Feet

Scale


Key Trench
P.T.
E
D
C
D = 30°54'
R = 287.2'
X = 94
T = 60'



UPPER DAM


A
A-20
Arch Wall
Trench
15
10
INLET
Itdm 10
P.C.
DAM.

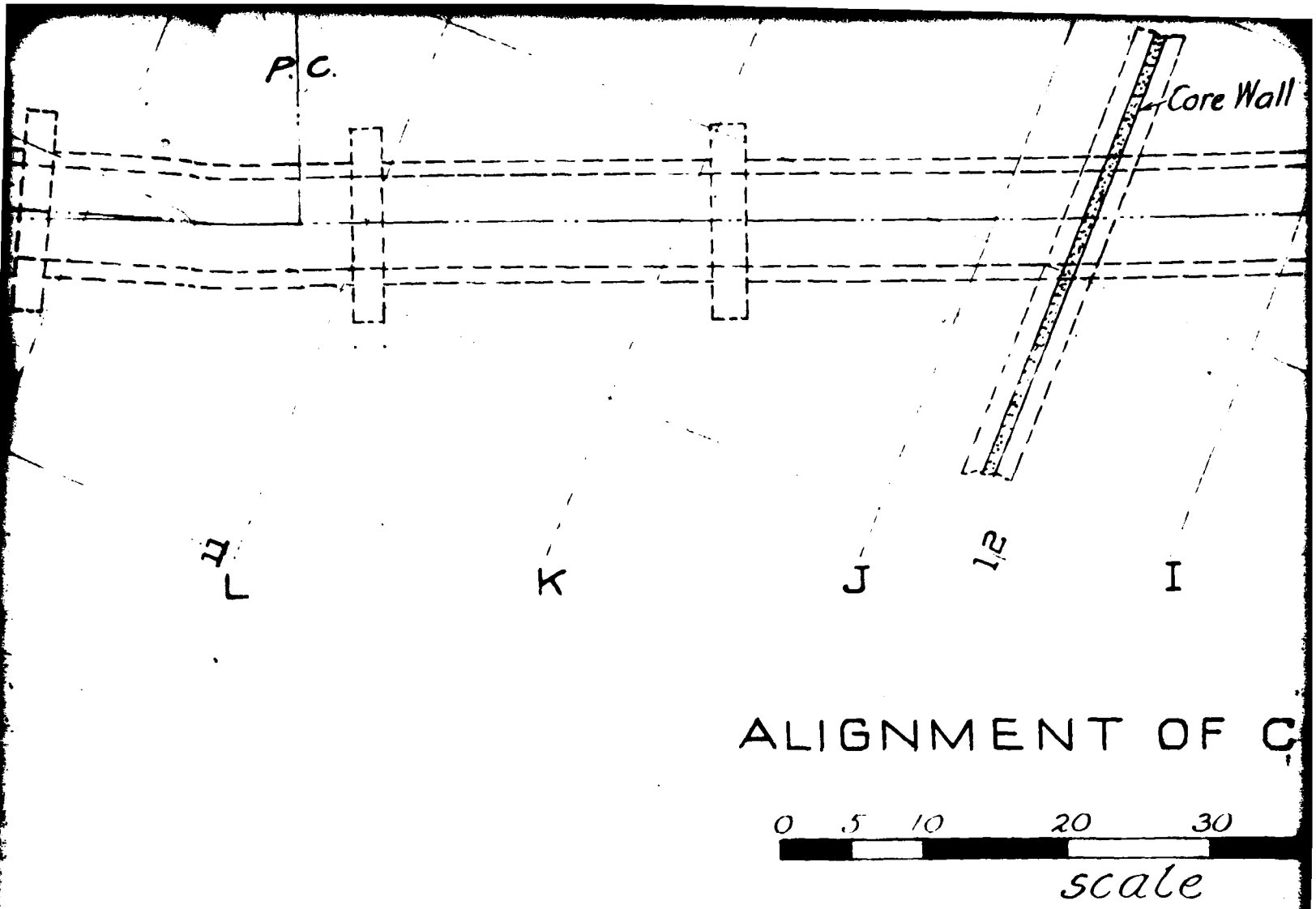
AD-A105 820 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. WATERVLIET UPPER DAM (INVENTORY NU--ETC(U)
JUL 81 G KOCH DACW51-79-C-0001

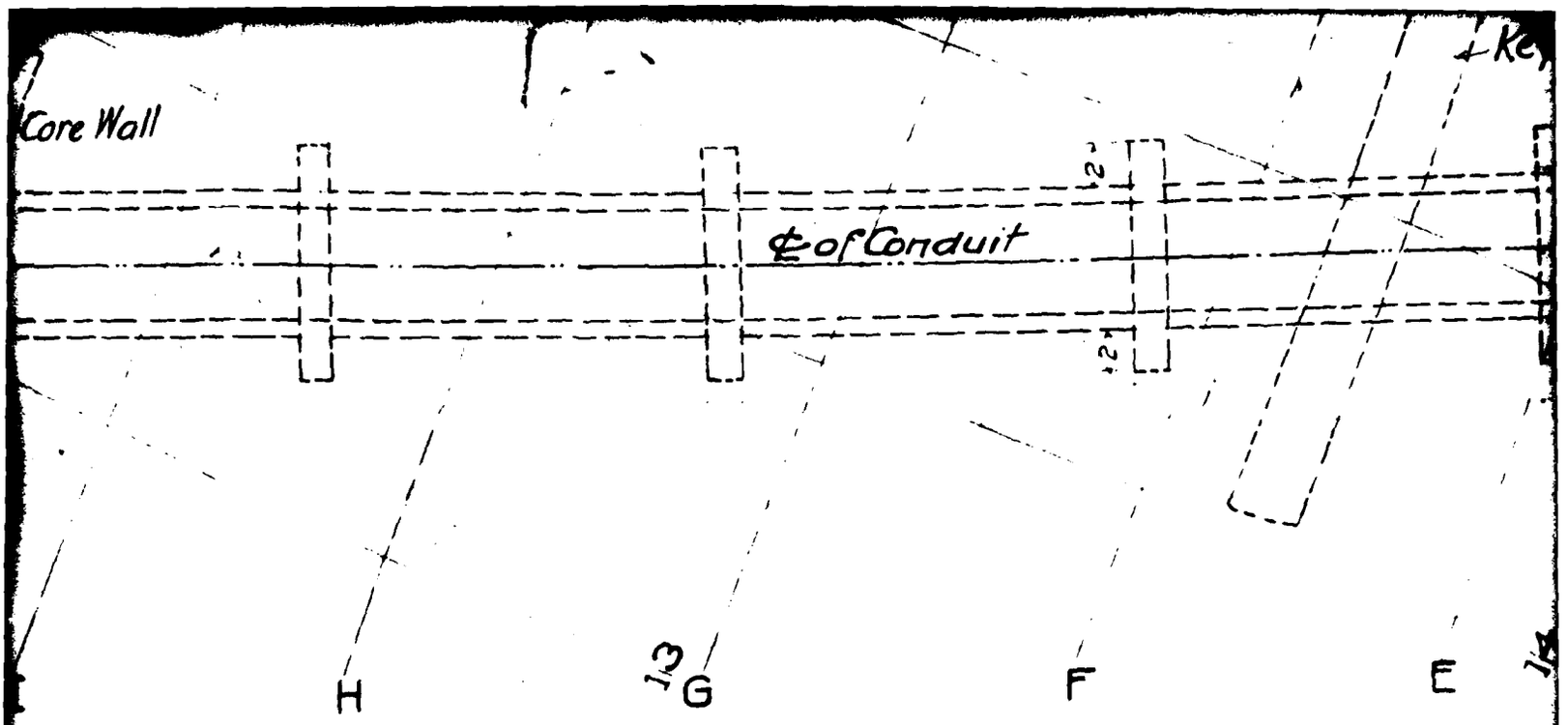
UNCLASSIFIED NL

2 OF 2
AD A
105 820

END
DATE FILMED
11-81
DTIC

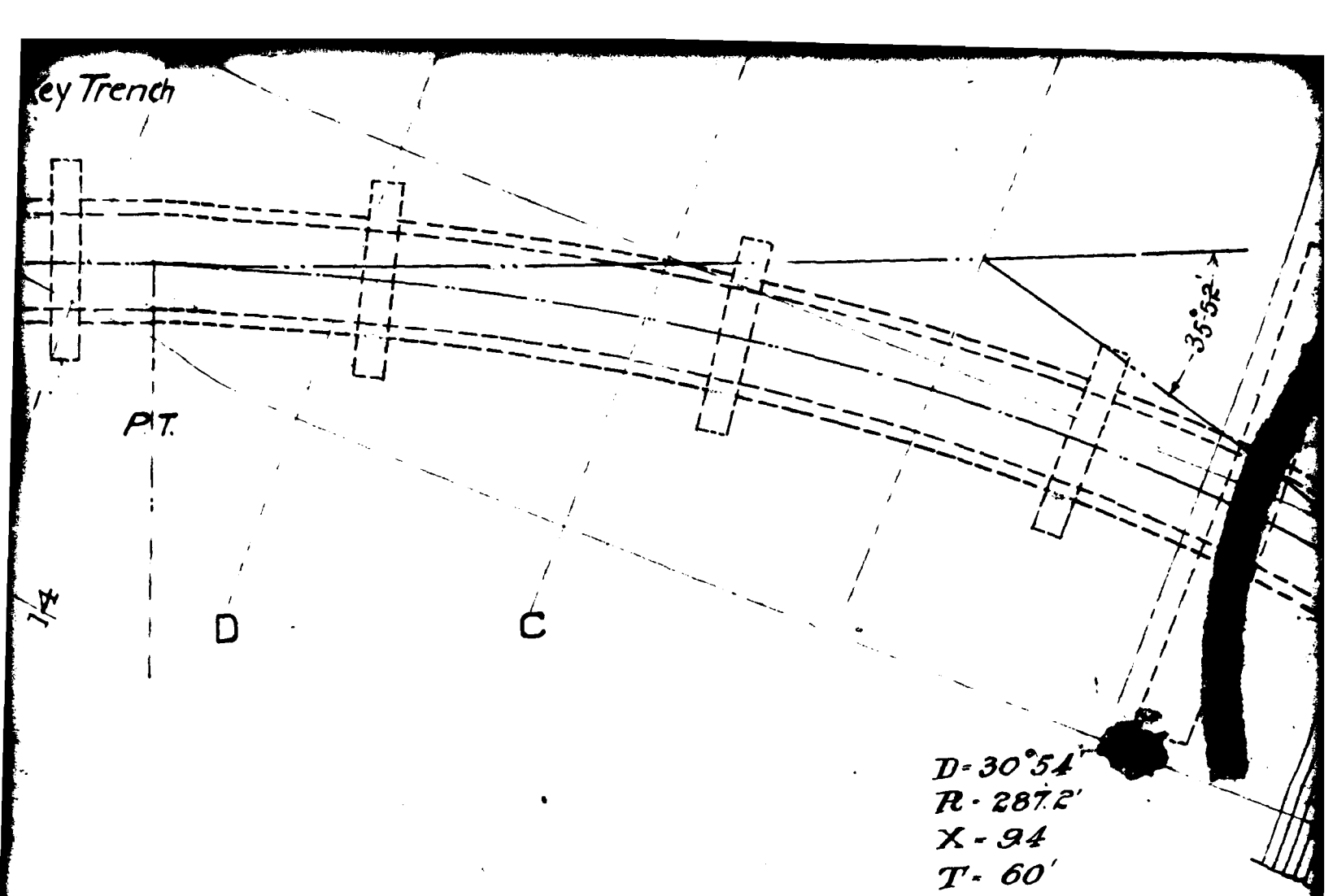
P.C.
20.38
O
10
N
M
11
L


P.C.
Core Wall
L
K
J
12
I
ALIGNMENT OF C
0 5 10 20 30
scale



F CONDUIT.

30 40 50 Feet



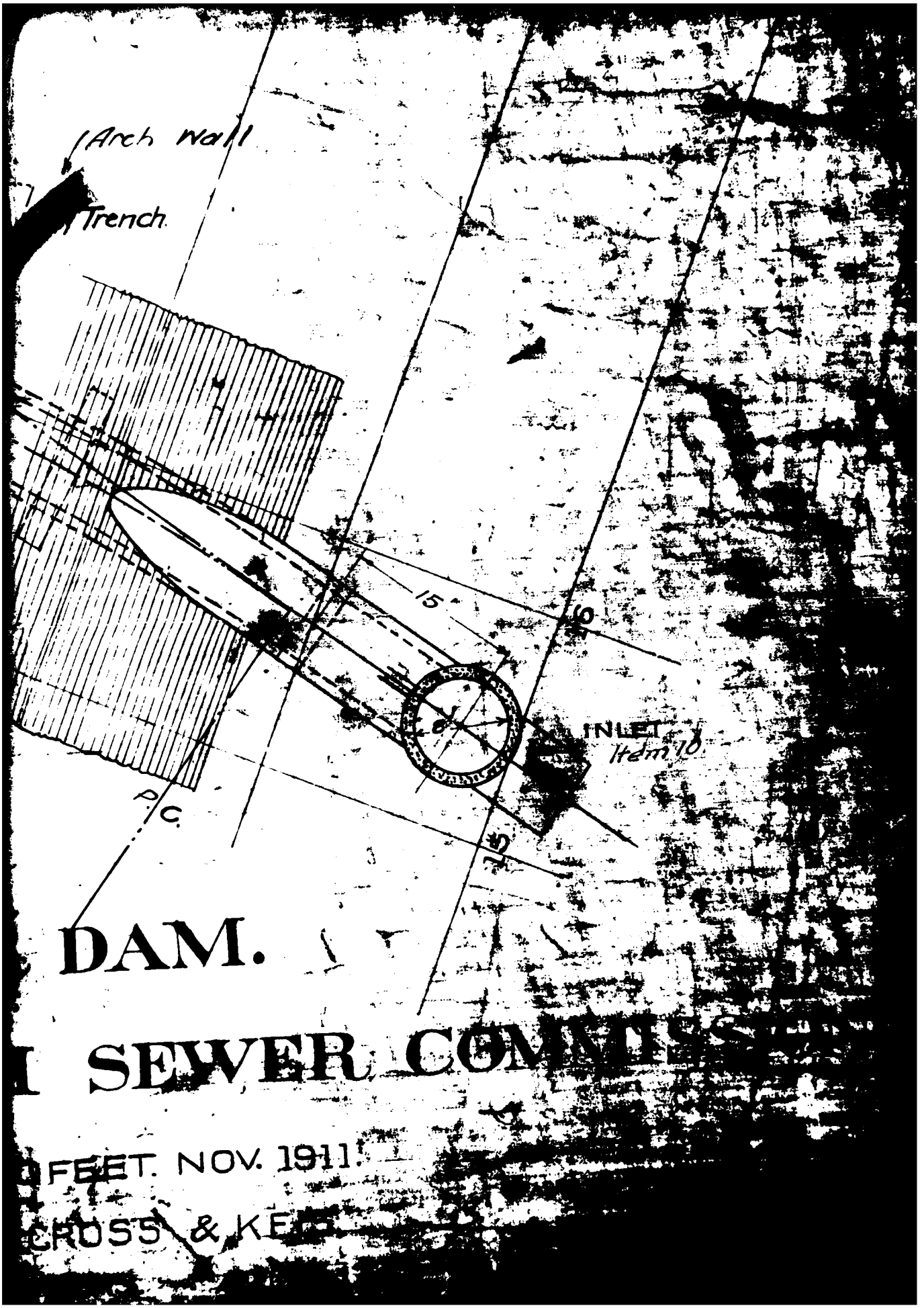
UPPE

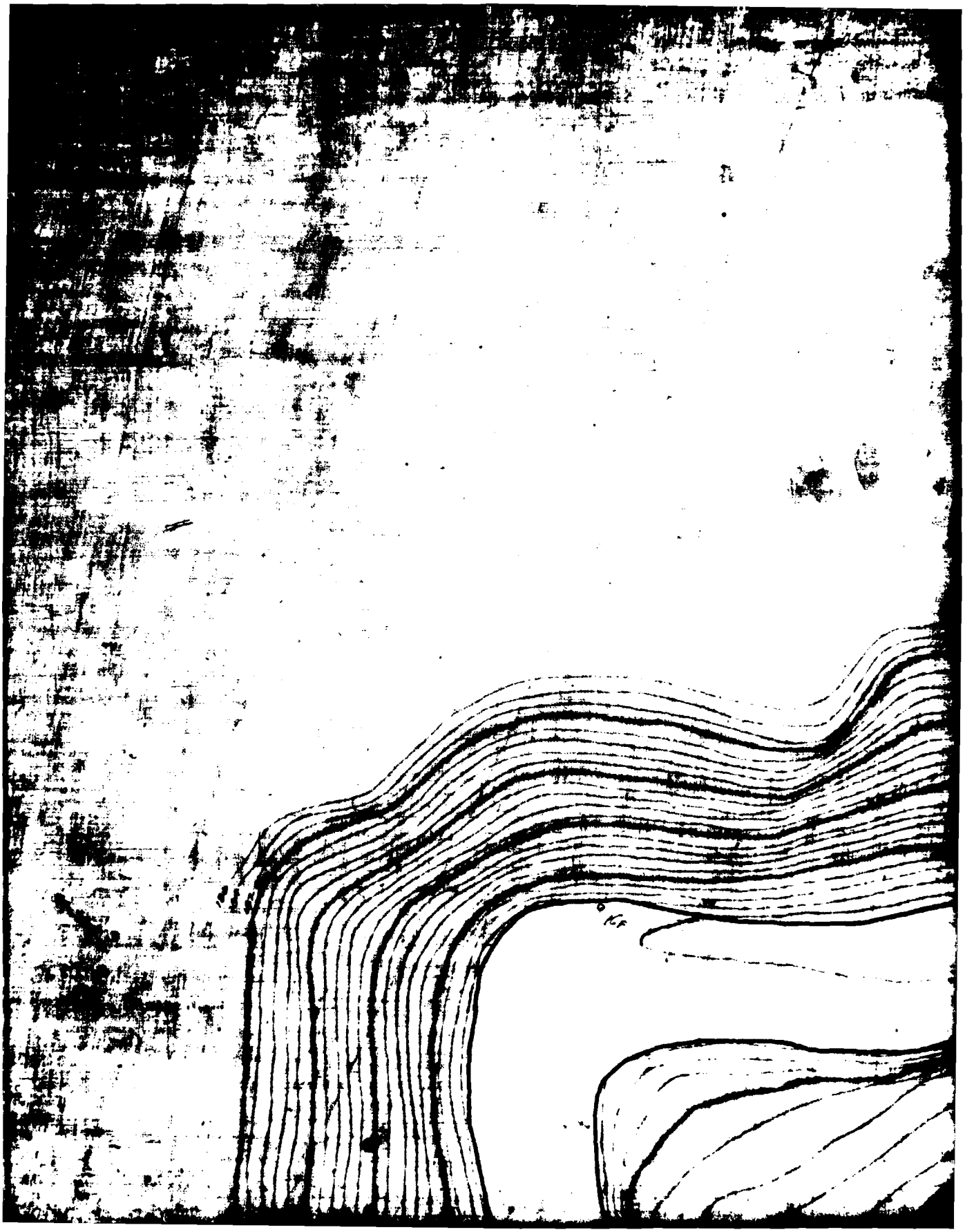
WATERVLIET STOR

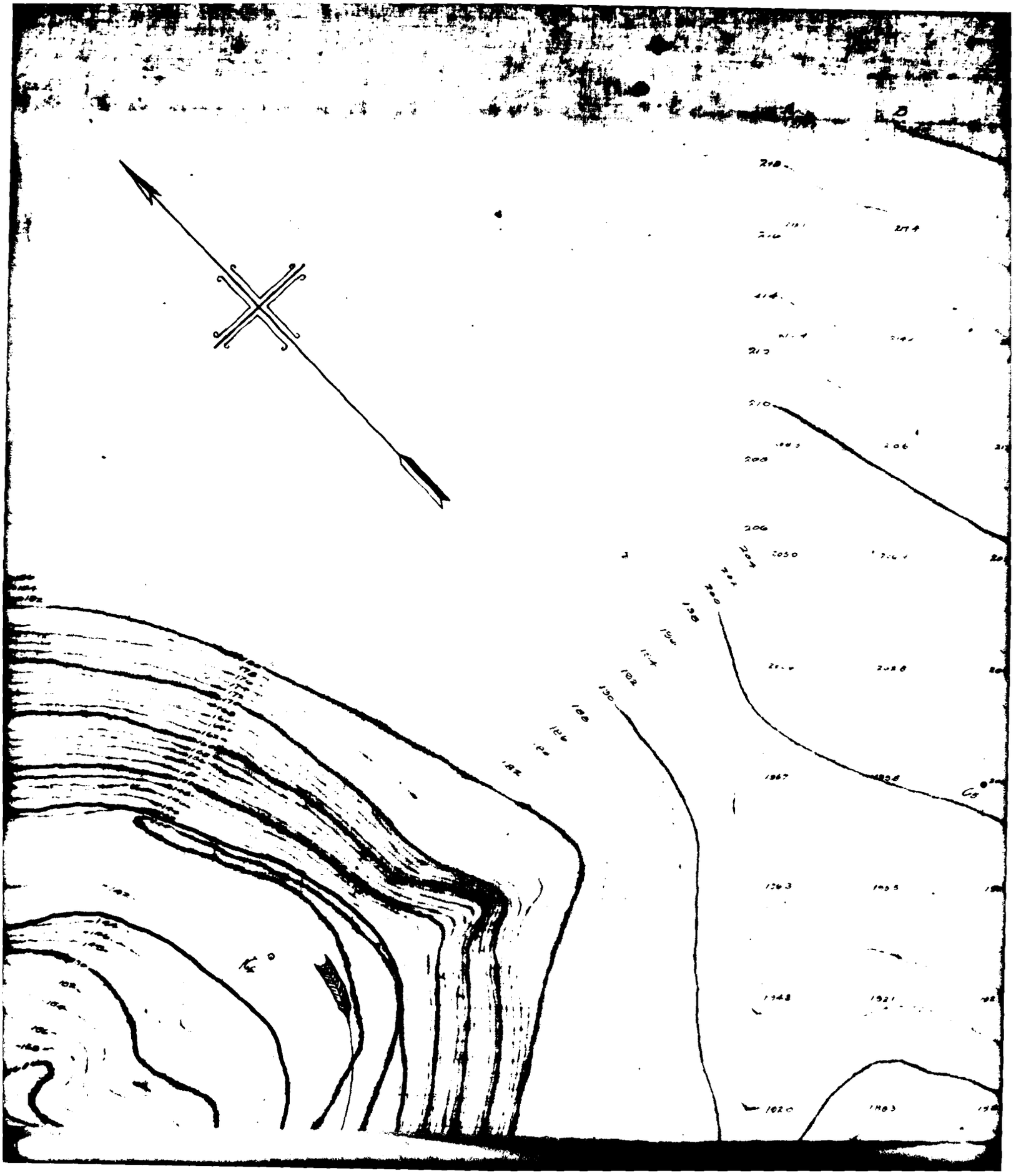
SCALE 1 INCH

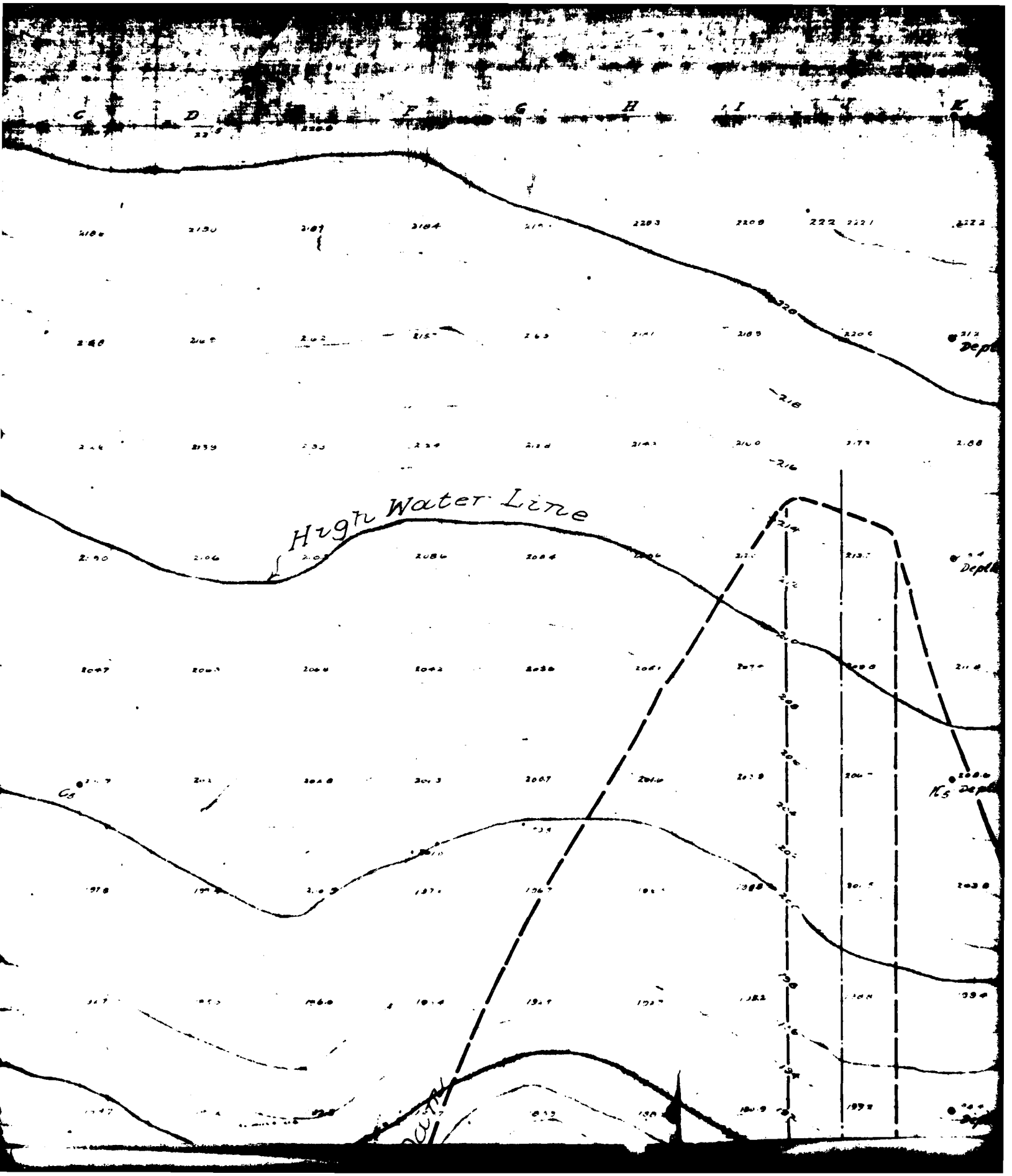
SOLOMON N

WATERVLIET

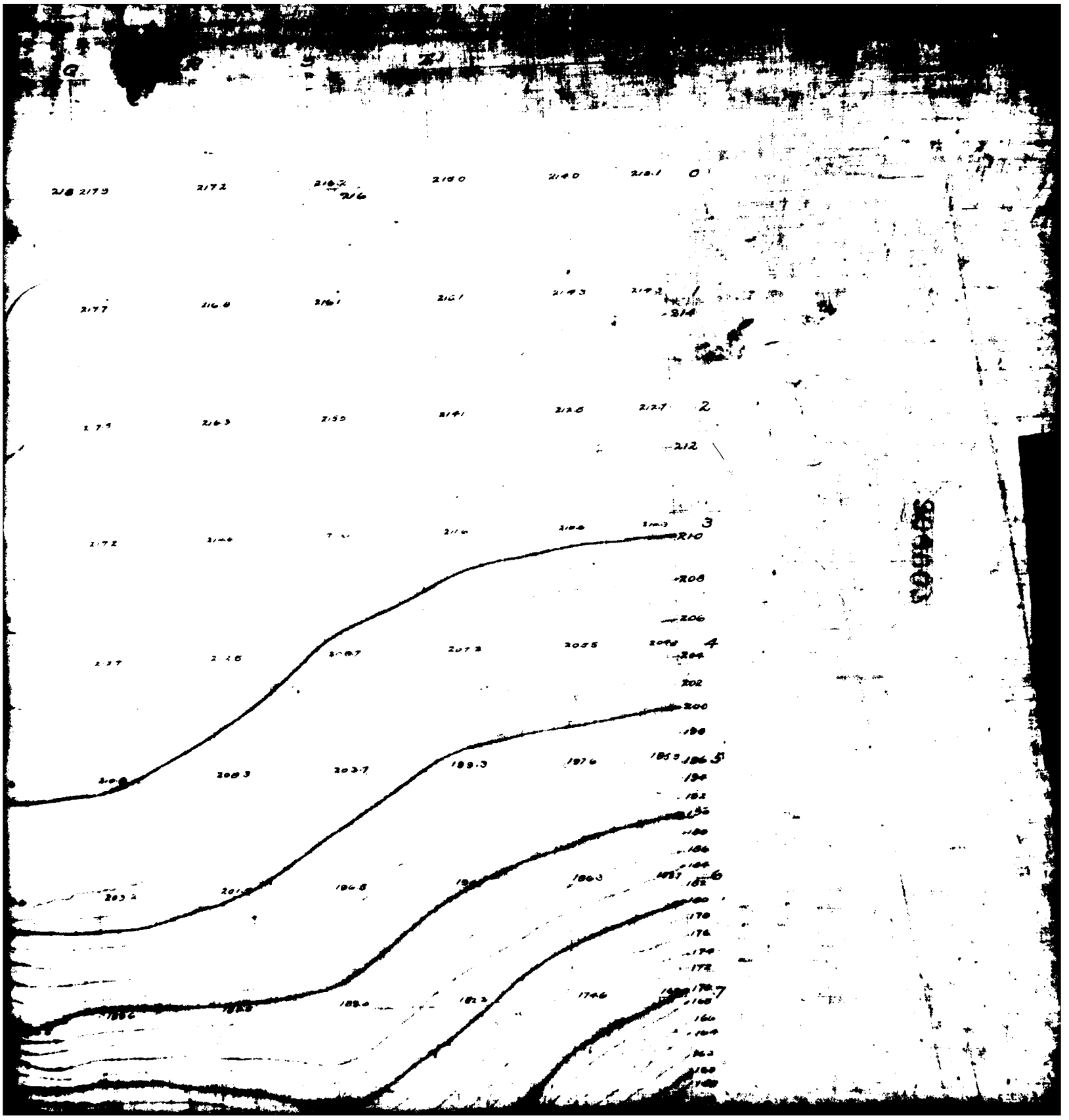

Arch Wall
Trench
15
INLET
P.C.
DAM.
SEWER
FEET. NOV. 1911.
CROSS & KE

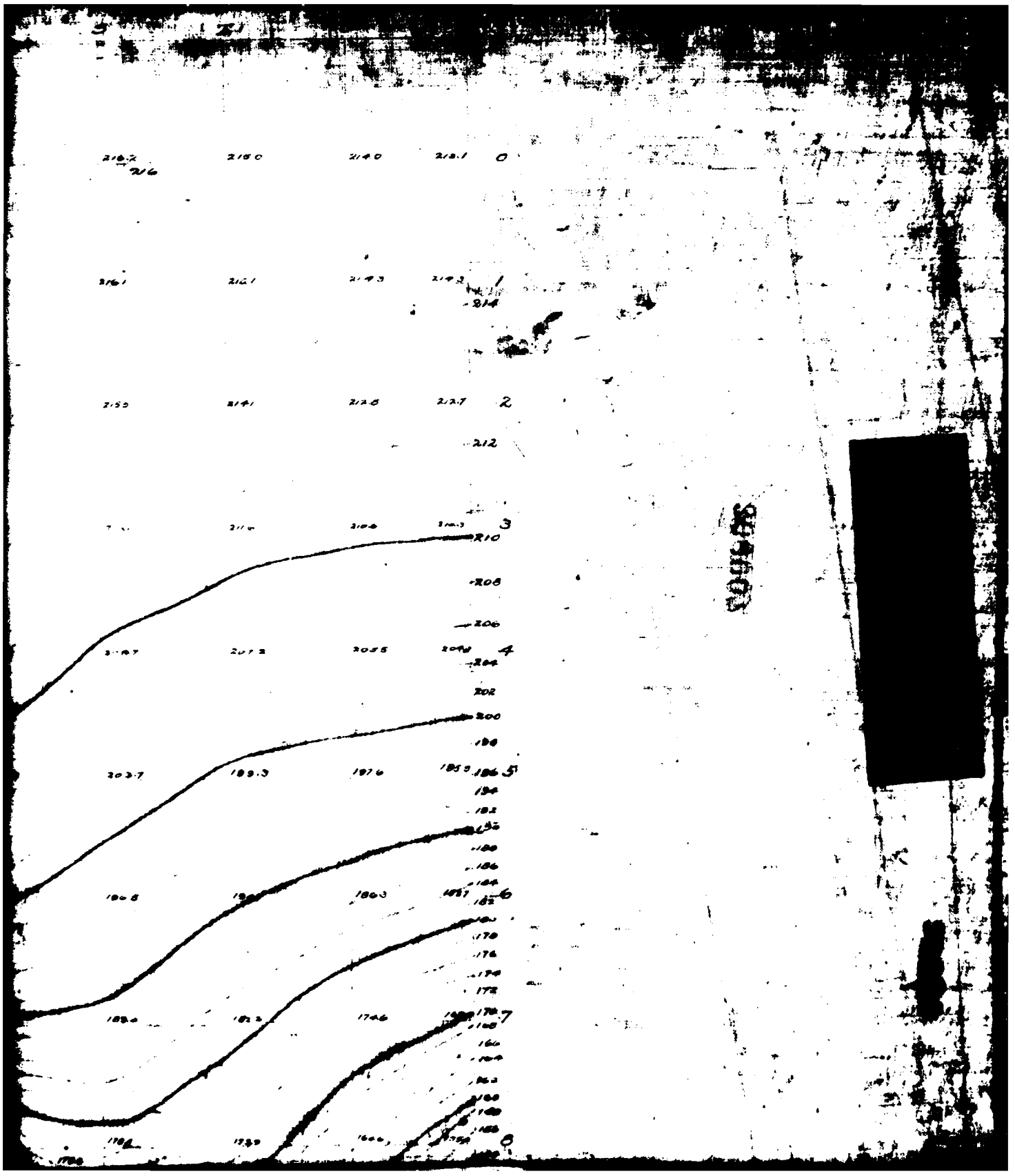

Kp

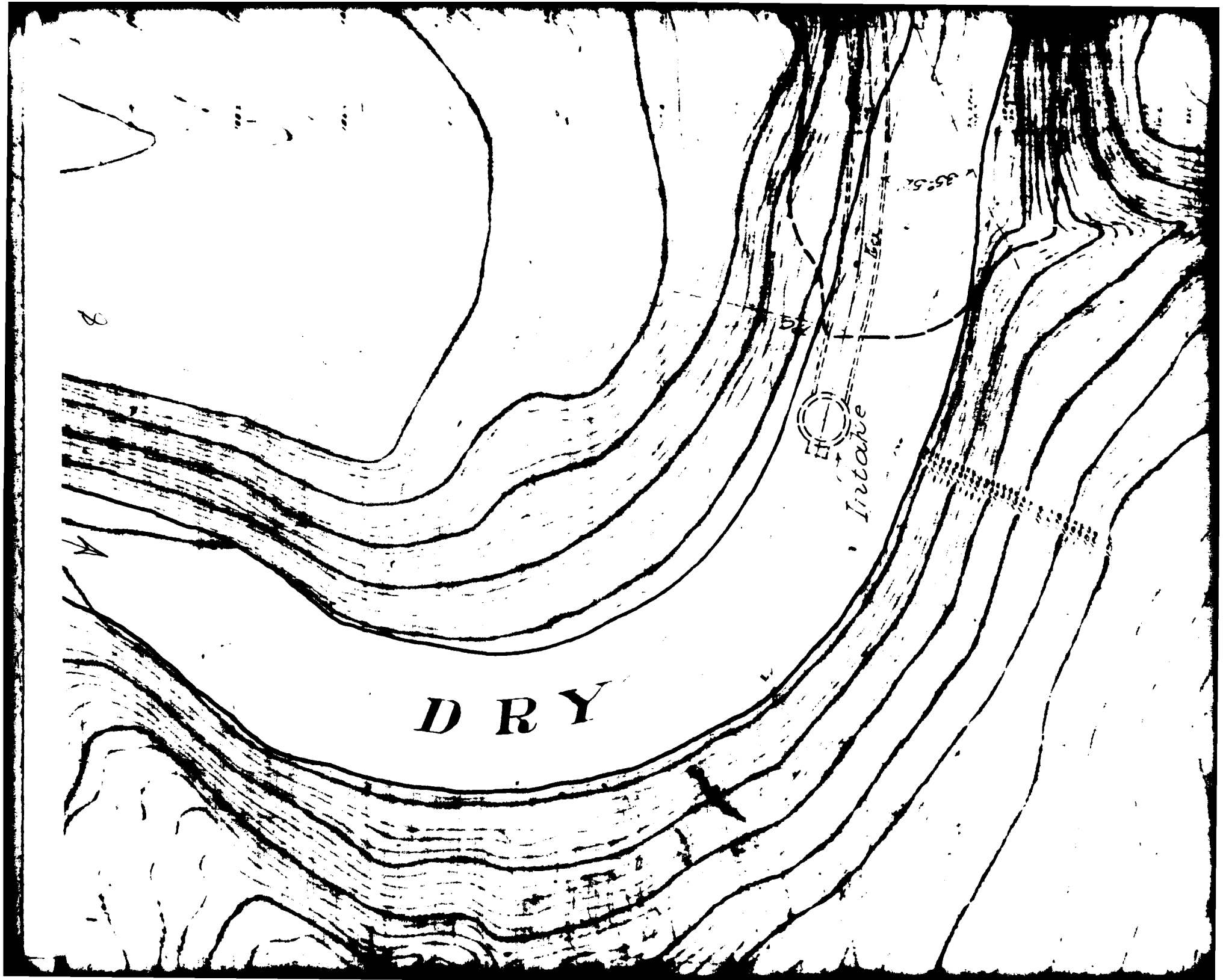


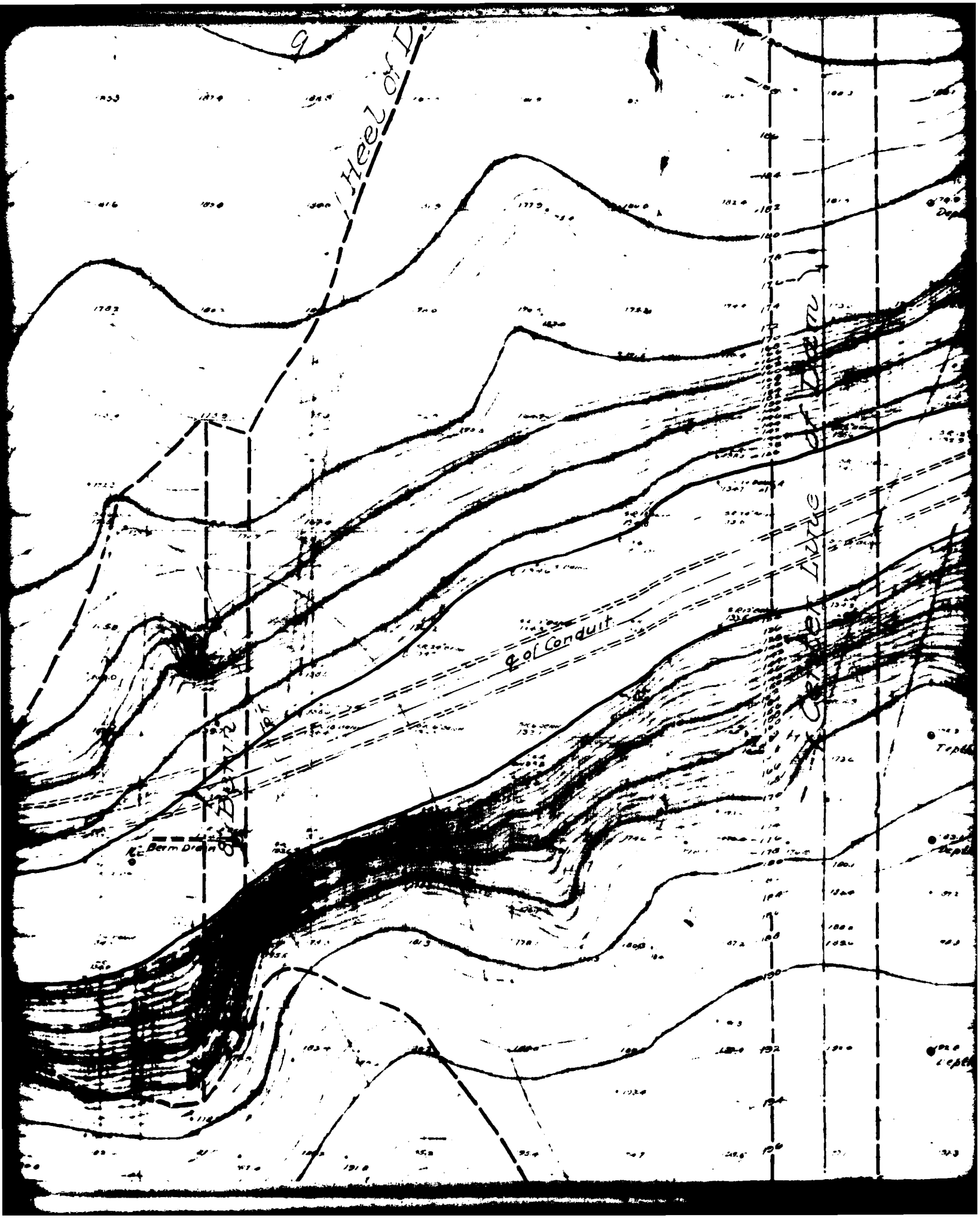

C
D
F
G
H
I
K
E
High Water Line
Depth
Depth
Depth
C5
K5

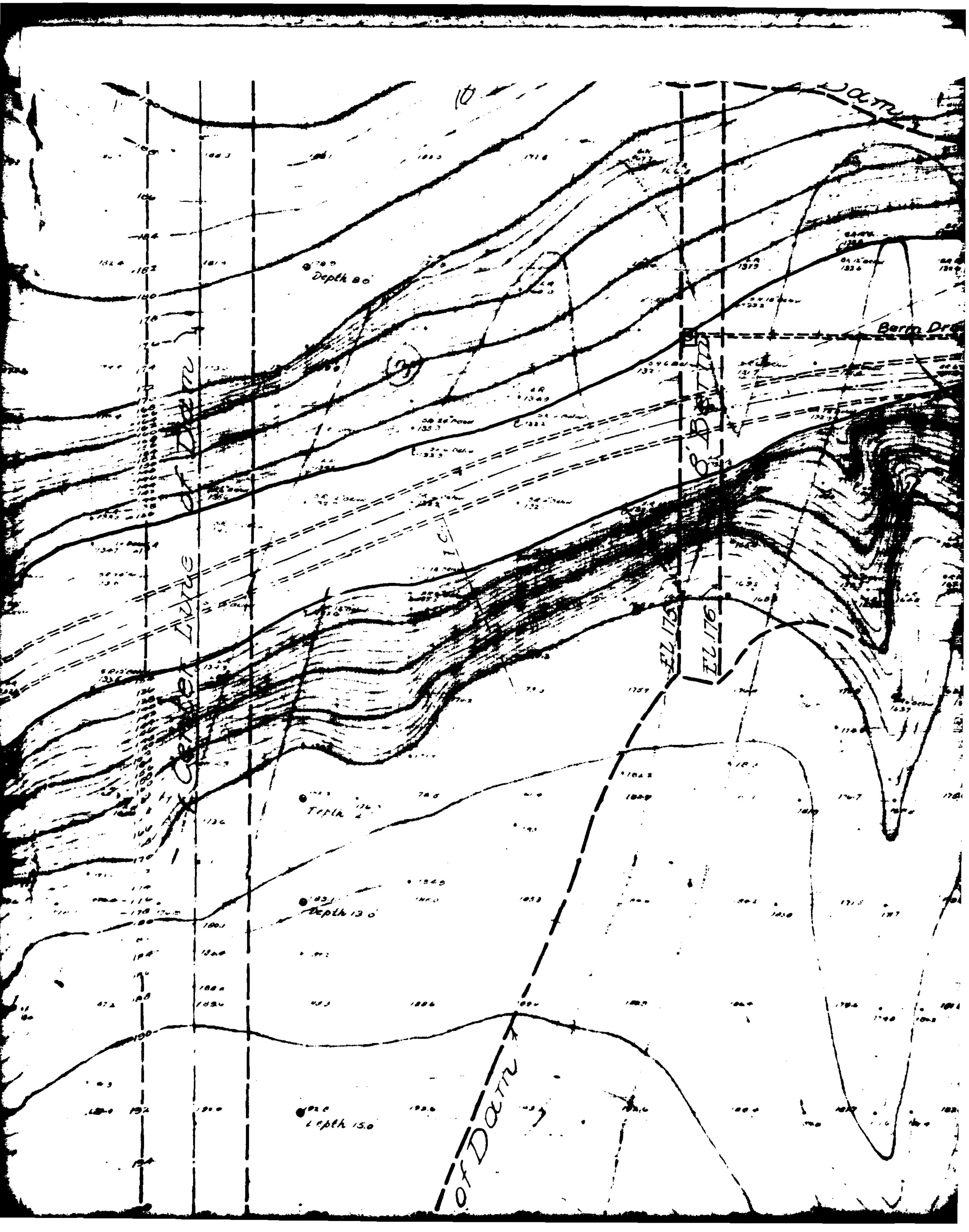

K
L
M
N
O
P
Q
R
S
Depth 15.0
Depth 15.0
K5 Depth 13.0'
KA

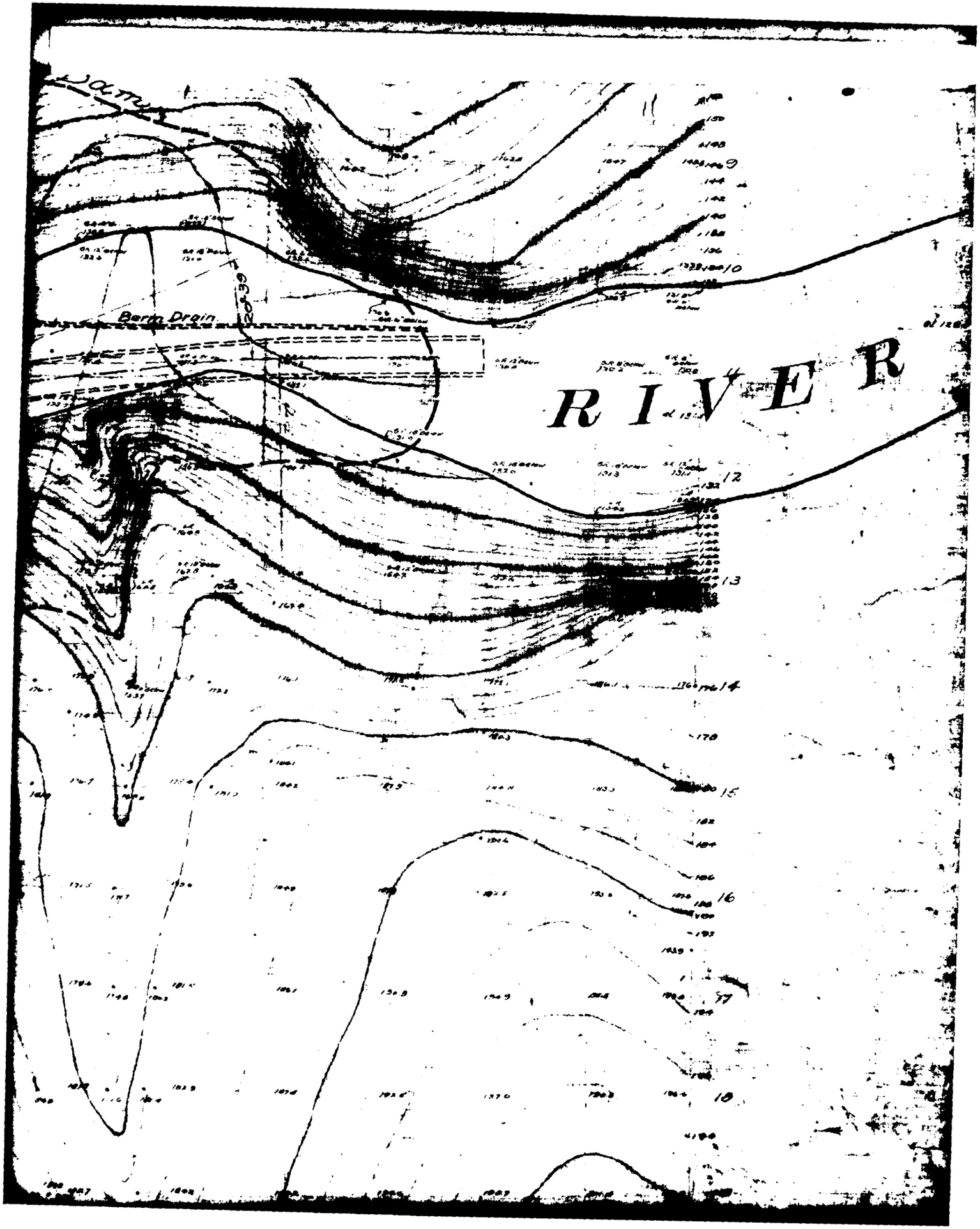


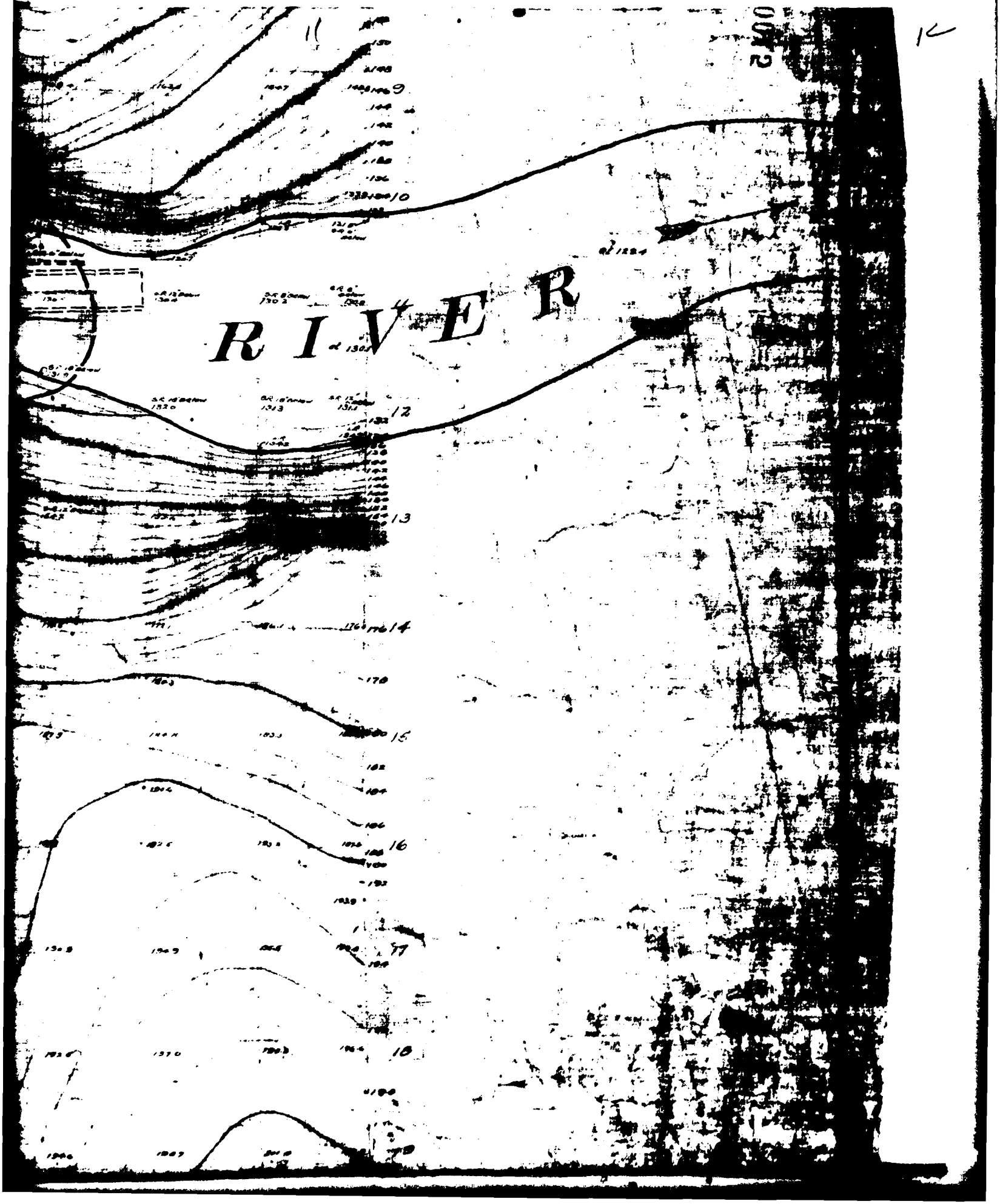


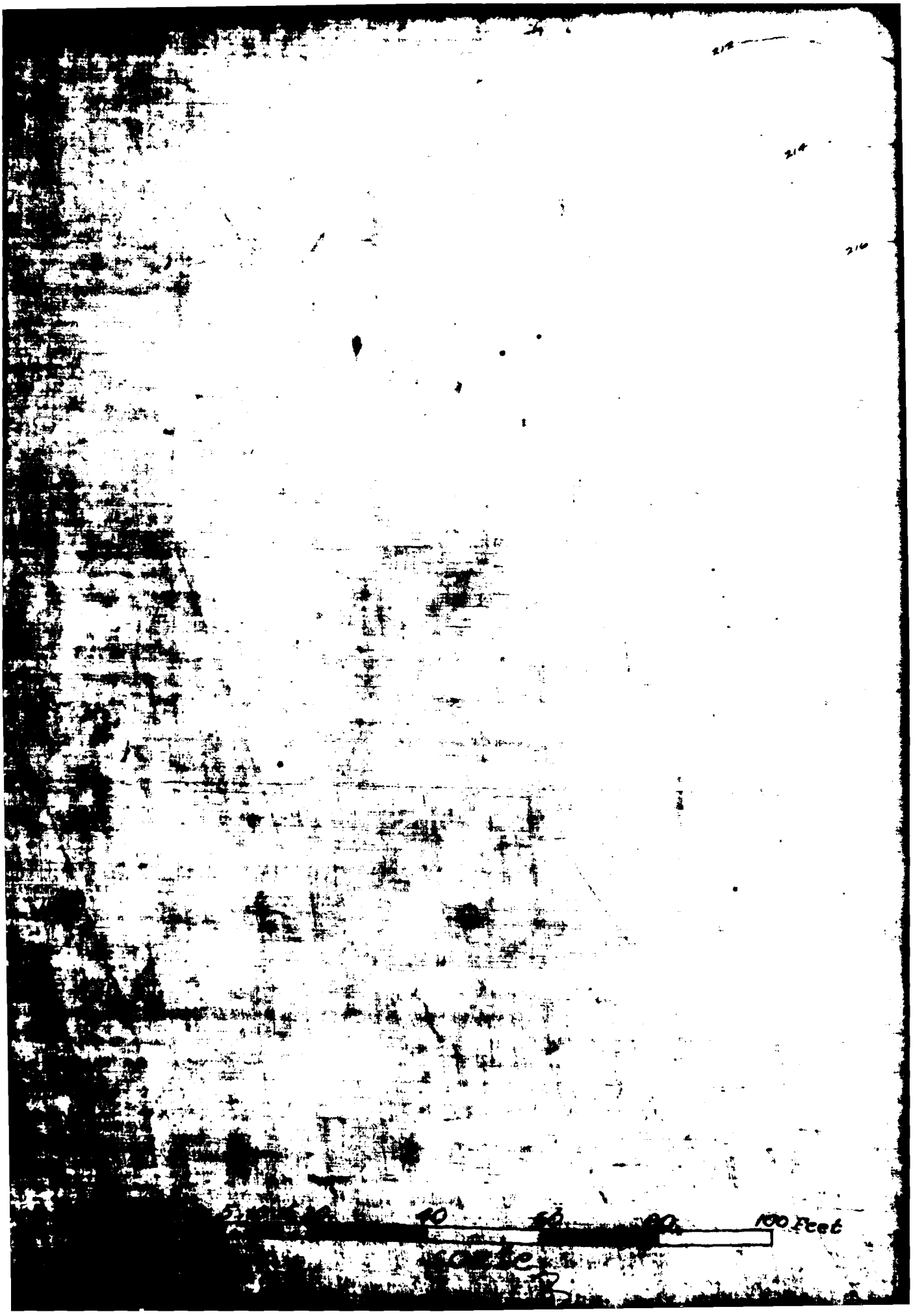

DRY
Intake

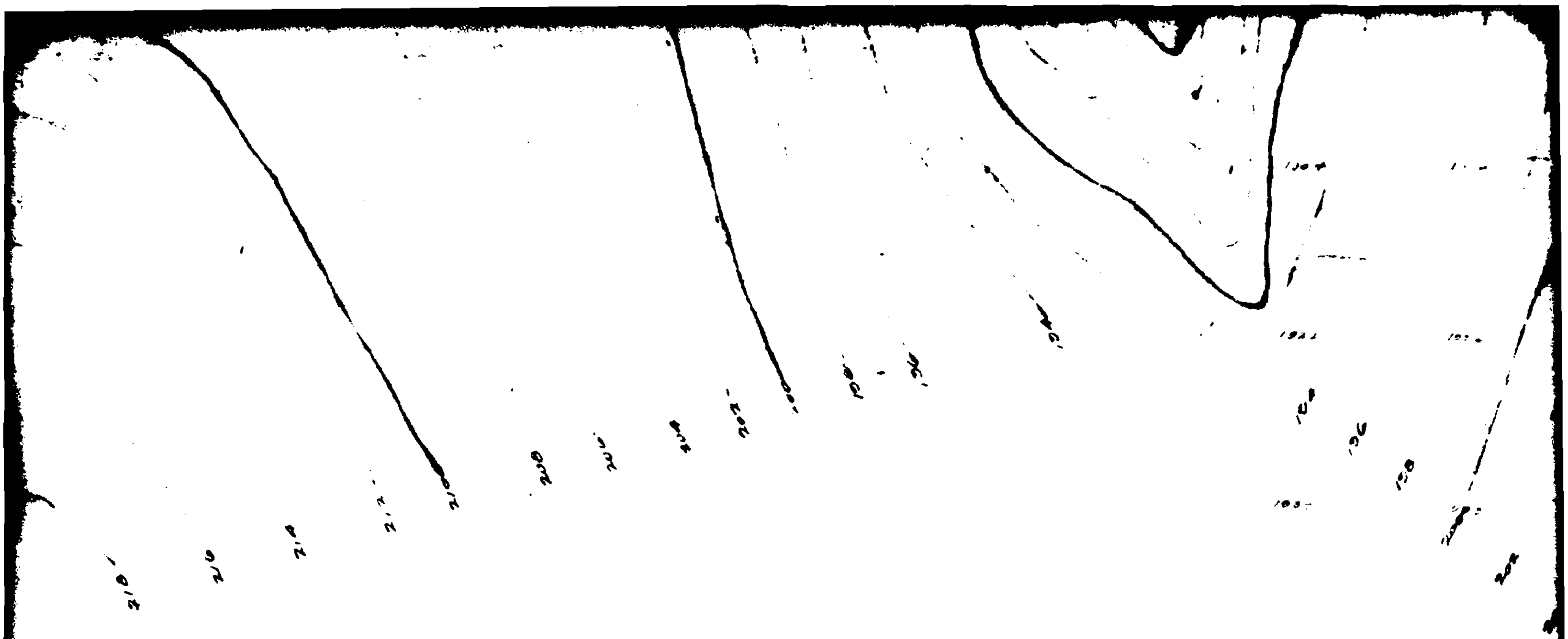

Heel of Dam
Center Line of Dam
Toe Drain
Berm Drain
Conduit

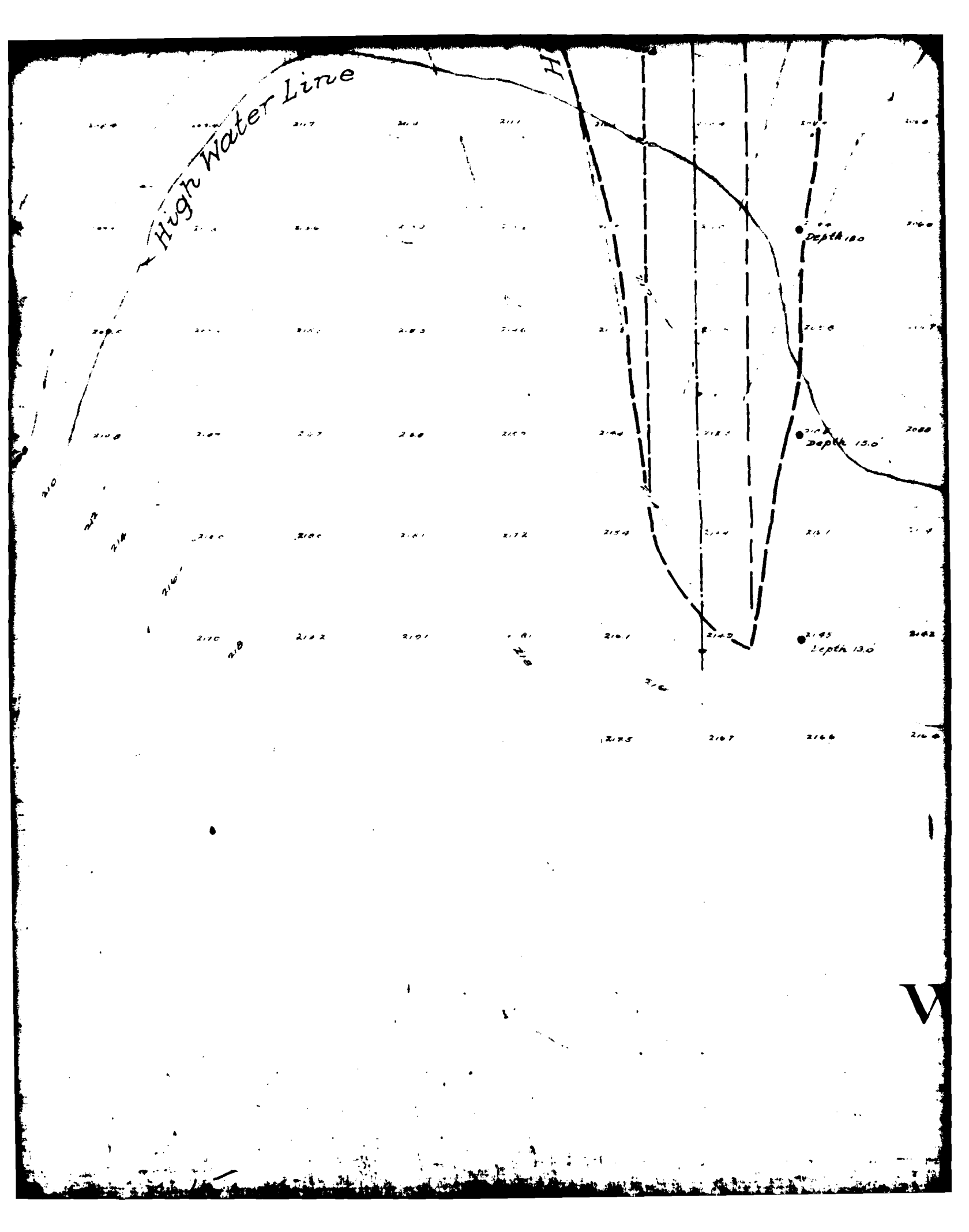

Center Line of Dam
6' Berm
EL 175
EL 176
Depth 8.0
Depth 13.0
Depth 15.0
of Dam

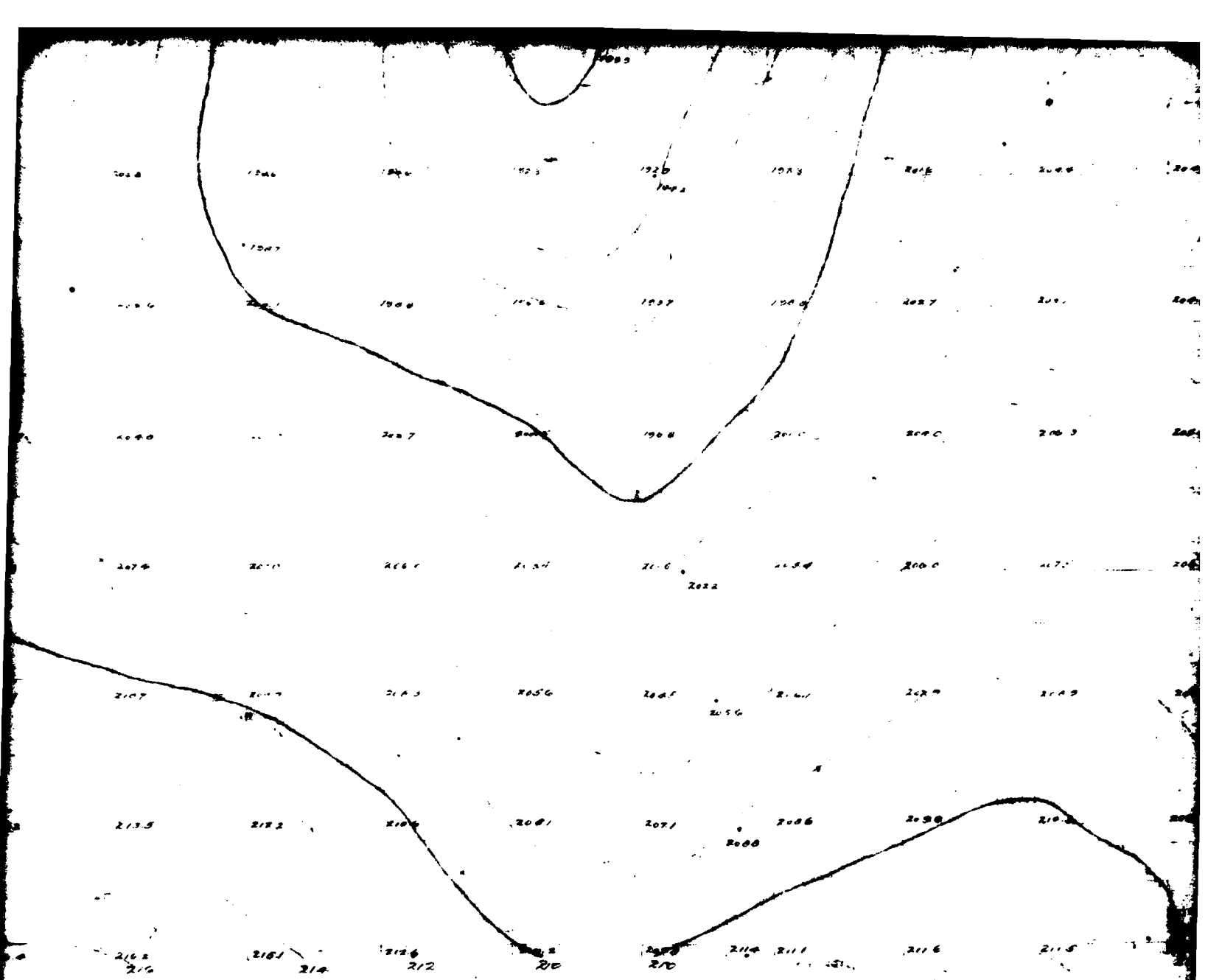

Berm Drain
RIVER


RIVER


214
214
210
100 Feet




High Water Line
Depth 18.0
Depth 13.0
Depth 13.0



MAP

OF

UPPER DAM SI

DRY RIVER BASIN

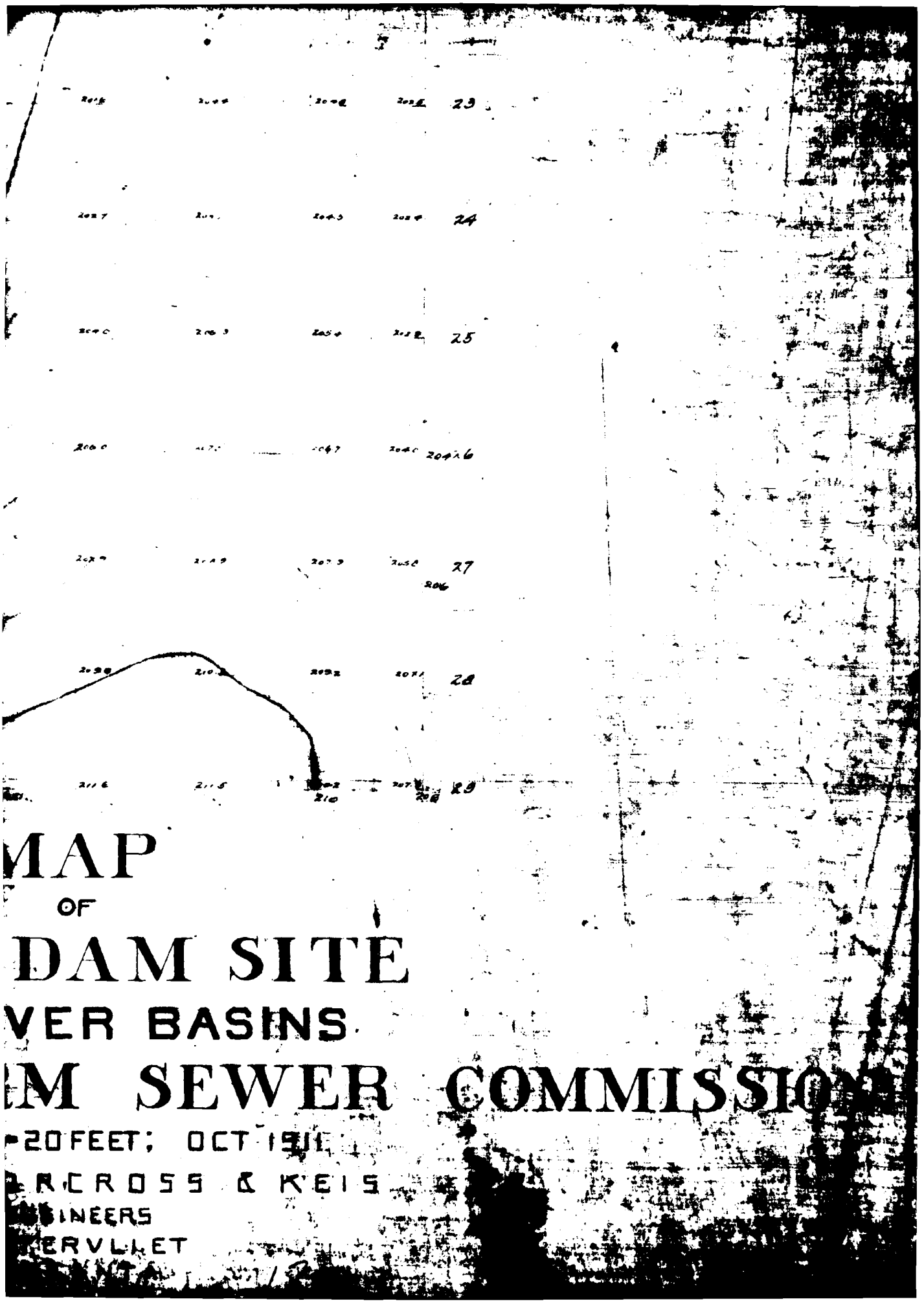
WATERVLIET STORM SEWI

SCALE: 1 INCH = 20 FEET; OCT 1

SOLOMON, NORCROSS & K

ENGINEERS

WATERVLIET


23
24
25
204 & 6
27
206
28
29
210
MAP
OF
DAM SITE
VER BASINS
M SEWER COMMISSIO
-20 FEET; OCT 191
R CROSS & KEIS
GINEERS
ERVLLET